Missouri Department of Natural Resources
Air Pollution Control Program

July 2003

Technical Support Document for Determination of Nonattainment Boundaries in Missouri for the 8-hour Ozone National Ambient Air Quality Standard

In July 1997, the U.S. Environmental Protection Agency (EPA) published a revision to the ozone National Ambient Air Quality Standard (NAAQS). This revision changed the level and averaging time for the standard: old – 0.12 ppm and 1 hour, new – 0.08 ppm and 8-hour. In May 1999, the U.S. Court of Appeals for the D.C. circuit remanded the 8-hour ozone standard while reaffirming EPA's ability to make designations. These designations are usually recommended by the Governor of each state and acted on by EPA. On January 28, 2000, EPA petitioned for Supreme Court review of the case. Meanwhile, EPA asked for governor's recommendations in June 2000. The state of Missouri provided its previous recommendations to EPA in July 2000. On February 27, 2001, the Supreme Court unanimously upheld the constitutionality of the 1970 Clean Air Act provision that authorizes EPA to set national ambient air quality standards to protect public health and welfare. On May 30, 2002 representatives of nine environmental organizations filed a notice of a citizen suit under the Act alleging that the EPA Administrator failed to promulgate air quality designations by the required statutory deadline. EPA and the environmental groups have agreed upon a schedule for EPA to promulgate air quality designations for the 8-hour ozone standard in a consent decree filed with the U.S. District Court for the District of Columbia on November 13, 2002. The designations will be made by April 15, 2004. Pursuant to this schedule, EPA asked states' governors to submit "updated, revised, or new designation recommendations to the Regional Administrator by April 15, 2003." This submittal deadline was later revised to July 15, 2003.

In these recommendations, areas can be classified as nonattainment (does not meet, or contributes to a nearby area that does not meet the NAAQS), attainment (meets the NAAQS), or unclassifiable (cannot be classified on available data). EPA's action can be approval of the recommendations or promulgation of new designations that differ from the Governor's recommendation. This revised document provides the technical basis for this recommendation by the state of Missouri. The information contained in the original technical support document was considered in the development of the information presented in this submittal. Much of that information is still valid and can be used as supporting documentation for this submittal.

In the March 28, 2000, guidance on establishing nonattainment boundaries for the 8-hour ozone NAAQS, EPA suggested that "the Metropolitan Statistical Area (MSA) or Consolidated Metropolitan Statistical Area (CMSA) serve as the presumptive boundary for 8-hour NAAQS nonattainment areas." Therefore, the analysis provided in this

document will focus on current Missouri MSAs that have counties that violate the current level of the 8-hour NAAQS from 2000-02. However, some additional counties will be addressed in order to provide sufficient information to distinguish trends regarding emission, population, and air quality trends within the immediate area around the MSA.

EPA has also stated that states may recommend areas larger than the current MSA if additional counties contain sources, population, commuting patterns or other factors that contribute to the nonattainment problem. Conversely, states may request smaller nonattainment areas where counties or portions of counties do not contribute to the problem area and can be considered rural in nature. Areas with 1-hour NAAQS compliance problems, EPA suggested that the designated 8-hour nonattainment area boundary be the same as or larger than the existing 1-hour nonattainment area boundary. The guidance spells out eleven additional criteria for evaluation of the boundaries. These include:

(1) Emission and air quality in adjacent areas (including adjacent C/MSAs)
(2) Population density and degree of urbanization including commercial development (significant difference from surrounding areas)
(3) Monitoring data representing ozone concentrations in local area and larger area (urban or regional scale)
(4) Location of emission sources (emission sources and nearby receptors should generally be included in the same nonattainment area)
(5) Traffic and commuting patterns
(6) Expected growth (including extent, pattern, and rate of growth)
(7) Meteorology (weather/transport patterns)
(8) Geography/topography (mountain ranges or other air basin boundaries)
(9) Jurisdictional boundaries (e.g. counties, air districts, existing 1-hour nonattainment areas, Reservations, etc.)
(10) Level of control of emission sources
(11) Regional emission reductions (e.g. NOx SIP call or other enforceable regional strategies)

All these factors will be presented in this analysis. Based on our understanding of the criteria and Missouri's current air quality condition, there are four different major contributing factors for designation of areas: (1) ambient monitoring data, (2) emission inventory data, (3) meteorological data, and (4) degree of urbanization or "connectivity" data. Each of these four factors has overlap into one or more other factors in the analysis. The ambient monitoring data portion is the most straightforward, either an area is monitoring violations of the 8-hour ozone standard or it is not. The extent and nature of the monitoring data could raise questions regarding areas without monitoring near a violating monitor. The remaining three factors can be utilized to address the contribution of nearby areas to monitored non-attainment. The majority of the documentation presented in this document is intended to address this more complex question of contribution to monitored non-attainment areas. The March 2000 guidance is not specific about the weight any one factor is given versus any other factor(s). The technical decision-making process should include analysis of all the available data for the

appropriate areas. Therefore, APCP has chosen to incorporate emission and degree of urbanization information into numerical (percentage-based) output to provide metrics for consideration outside of meteorological variables. Then, a single numeric contribution can be established for consideration. Based on available data from Kansas, Illinois, and APCP datasets, this information may not be identical for Kansas City and St. Louis. However, the concepts and process for evaluation will be identical. After the development of this metric, the meteorological analysis and other ancillary information will be utilized to provide a more detailed evaluation of areas where the initial evidence supports further analysis.

The meteorological analysis was conducted for both the St. Louis and Kansas City areas and is presented collectively to illustrate the synoptic patterns of ozone formation in the state of Missouri.

METEOROLOGY OF 8-HOUR OZONE FORMATION IN MISSOURI

The Environmental Protection Agency has defined the ozone season for Missouri as April 1st through October 31st. During this time, the synoptic scale pattern that emerges is one in which local weather conditions are dominated by subtle shifts in the position of the Bermuda high located over the western Atlantic Ocean. The flow around this high-pressure center brings southerly flow to the region along with warm, humid air that often leads to hazy conditions during the summer months. This high-pressure region coupled with convective activity during the hottest part of the summer, and the passage of frontal boundaries leads to highly variable spatial and temporal ozone concentrations in both the Kansas City and St. Louis regions.

In order to reduce the frequency and severity of elevated ozone concentrations, a basic understanding between meteorological conditions and ozone concentrations is essential and can aide in the selection of episodes for photochemical modeling, the determination of control strategies, and for tracking trends in ozone concentrations. In an effort to achieve this goal, the Department's Air Pollution Control Program conducted a study to identify key meteorological conditions that repeatedly lead to ozone concentrations in excess of 85 parts per billion. These conditions were then classified into regimes to determine what set of conditions lead to the most frequent and severe concentrations in Kansas City, St. Louis and their surrounding air basins.

AIR QUALITY MONITORING AND METEOROLOGICAL DATA

Ambient air quality monitoring and meteorological data for the most recent three year period for which comprehensive data were available were selected for this analysis and include the following years: 2000, 2001, and 2002. The use of the latest three years of air quality data will reduce concerns regarding significant differences in ozone precursor emissions due to controls and/or growth within each area. However, the use of three years does not provide a comprehensive examination of all meteorological conditions that will cause exceedances of the 8-hour ozone National Ambient Air Quality Standard (NAAQS). The information contained within this evaluation led to the understanding that the severity of meteorological conditions necessary to cause 1-hour ozone exceedances does not have to be present for 8-hour ozone exceedances in Kansas City or St. Louis.

For the purposes of this study, an ozone episode was defined as day(s) that either had concentrations over the 8-hour ozone NAAQS (85 parts per billion) or days that were part of an increasing pattern of ozone in the region. The days leading up to ozone concentrations in excess of the NAAQS allowed data reviewers to determine what type of meteorological pattern was in place during ozone events. The identification of these episodes will also provide valuable information regarding the appropriateness of these events for input into future photochemical modeling studies that may be required under the Clean Air Act. The episodes identified for the St. Louis and Kansas City Regions are contained in Appendix A - Tables 1 and 2, respectively. Additional data concerning meteorological conditions were obtained from the National Weather Service stations

located at Lambert International Airport and the Kansas City International Airport for the surface and 850 millibar levels.

METEOROLOGICAL REGIME DEVELOPMENT

The meteorological analysis that was completed within the study region revealed that a key set of variables define the synoptic and micro-meteorological features that are necessary for the production of elevated ozone concentrations in the State of Missouri. As stated above, previous research indicated that elevated 1-hour ozone concentrations would only occur under ideal conditions with temperatures greater than 85 degrees Fahrenheit, clear skies and surface wind speeds less than ten miles per hour. However, recent studies conducted by the Department's Air Pollution Control Program indicate that less severe meteorological conditions can lead to ozone exceedances under the new standard.

In order to identify "typical" meteorological conditions that lead to elevated 8-hour ozone concentrations, the Department's Air Pollution Control Program reviewed each day contained within Appendix A - Tables 1 and 2. To reiterate, the episodes chosen for this analysis were based upon concentrations approaching, or exceeding the NAAQS of 85 parts per billion. Initially, synoptic scale features at the surface and upper air levels were reviewed in conjunction with site-specific information obtained from the Kansas City International Airport and Lambert International Airport. The results of this initial review indicated that the vast majority of 8-hour episodes were multi-day events with specific synoptic scale weather patterns associated with them. The relative position of the synoptic scale features dictated what was occurring at the microscale meteorological level, which in turn dictated the characteristics of the ozone plume and the direction it traveled. Because the synoptic scale pattern is not static and is continually changing, each day within an episode that was over 85 parts per billion was identified and placed into a "meteorological regime." The meteorological regimes identified during this process were often recurring and evolved into a classification scheme that helped identify the conditions that resulted in the most frequent and severe ozone concentrations. Although the micrometeorological impacts differed across the state, several of the meteorological regimes that caused elevated ozone in St. Louis also resulted in elevated concentrations in Kansas City. Those regimes where overlap was observed are discussed collectively in the following paragraphs, with graphical representations attached as an appendix to this document. Again, it is important to note that one episode may be comprised of several regimes as synoptic features shift over time. Maps containing examples of the synoptic conditions associated with each regime are contained in Appendix A.

Meteorological Regime #1

Synoptic Features

Regime #1 occurs as a high pressure area develops over the Ohio River Valley forcing any lingering frontal boundaries to be pushed out of the region. As the day wears on, the center of the high pressure system

migrates to the northeast and establishes itself over the New England states. Frontal boundaries typically remain to the northwest with their area of influence limited to the High Plains.

Surface Features

St. Louis-The presence of the high pressure center over the Ohio River Valley during the morning hours often leads to calm, potentially hazy conditions. As the high pressure center migrates eastward over the New England states, the surface wind speeds increase slightly, but remain below ten knots. In most instances the predominate wind direction is from the southeastern quadrant. Slight variations in the position of the high pressure center determine if the winds are from the east southeast, southeast, or south southeast.

Kansas City-The presence of the high pressure center over the Ohio River Valley during the morning hours leads to hazy a.m. conditions, similar to the those reported across the St. Louis region under Regime #1. However, the surface a.m. wind speeds reported at Kansas City International Airport often approach ten knots in contrast to the calm a.m. conditions reported at Lambert International Airport. As the high pressure center migrates eastward over the New England states, the surface wind speeds increase slightly, but remain in the low teens. In most instances the predominate wind direction is from the eastern and southeastern regions.

Meteorological Regime #2

Synoptic Features

Regime #2 occurs as a high pressure area over the New England states retreats southward over the Mid-Atlantic states. The frontal boundary positioned over the High Plains in Regime #1 continues to move towards the Midwest as the afternoon high pressure center drifts off the eastern seaboard. Depending on the strength of the area of high pressure, the frontal boundary may continue its southeasterly path, or it may become stationary along the Missouri/Iowa border.

Surface Features

St. Louis-The surface conditions occurring during the 2nd regime are not as consistent as those associated with the first meteorological regime. The largest contributor to this variation in wind direction is often due to the proximity of the frontal boundary to the St. Louis metropolitan area. The predominate wind direction is often from the southwest with wind speeds less than ten knots. Again, a.m. calms are common. As frontal boundaries approach, the winds may shift to the southeast or north. With few exceptions, the winds remain at speeds less than ten knots.

Kansas City-Again, the surface conditions occurring during the 2nd regime in Kansas City are not as consistent as those associated with the first meteorological regime. The largest contributor to this variation in wind direction is often due to the proximity of the frontal boundary to the Kansas City metropolitan area. The predominate wind direction is often from the southeast with wind speeds less than ten knots with some wind gusts reaching the mid-teens. As with Regime #1, the a.m. wind speeds often remained below ten knots, however, the presence of calms was rare. As frontal boundaries approach, the winds may shift from the southeast to the north.

Meteorological Regime #3

Synoptic Features

Regime #3 occurs as the stationary front positioned along the Missouri/Iowa border, as seen in Regime #2, becomes mobile and continues its southerly advance though the State of Missouri. As the front approaches the St. Louis and Kansas City regions, early morning precursor emissions and/or ozone are forced southward causing higher concentrations of ozone to the south of each metropolitan area. The timing and intensity of the frontal boundary determines which sites report elevated concentrations.

Surface Features

St. Louis-The surface conditions occurring during this regime do not follow a consistent pattern due to the proximity of the frontal boundary to the St. Louis metropolitan area. Hazy conditions are often reported prior to the passage of a cold front with calm, variable winds common. As frontal boundaries approach, the winds may shift to the southeast or north. With few exceptions, the winds remain at speeds less than ten knots.

Kansas City- The surface conditions occurring during this regime do not follow a consistent pattern due to the proximity of the frontal boundary to the Kansas City metropolitan area. As frontal boundaries approach, the winds may shift from a southerly flow to a northerly flow. The wind speeds often remain in the low to mid teens.

Meteorological Regime #4

Synoptic Features

Regime #4 occurs as a high pressure area develops over the State of Iowa and migrates southward over Missouri. Further tracking of the high pressure center indicates that it will continue to move eastward over Illinois and Indiana. No predominate frontal systems are present within the region.

Surface Features

St. Louis-The presence of the high pressure center over the midsection of the United States during the morning hours often leads to calm, potentially hazy conditions. As the high pressure center migrates eastward into Illinois and Indiana, the surface wind speeds increase slightly, but remain below ten knots. In most instances the predominate wind direction is from the northeast quadrant. Slight variations in the position of the high pressure center determines the pattern of the surface flow.

Kansas City-The presence of the high pressure center over the midsection of the United States during the morning hours often leads to slow wind speeds and hazy conditions. As the high pressure center migrates eastward into Illinois and Indiana, the surface wind speeds increase slightly, but remain below ten knots. In most instances the predominate wind direction is from the southeastern quadrant. Slight variations in the position of the high pressure center determines the pattern of the surface flow.

Meteorological Regime #5

Synoptic Features

Regime #5 occurs less frequently than previous regimes as a high pressure areas develop over Canada and the Northern New England states. A frontal boundary will approach and pass through the State of Missouri and will remain to the east over the Ohio River Valley as a second boundary approaches from the West.

Surface Features

St. Louis-The presence of multiple frontal boundaries in the region typically leads to little or no formation of ozone. However, on the days with reported ozone exceedances, the frontal systems were in close proximity to one another and often trapped pollutants between their boundaries. With little or no precipitation reported and sunny skies, the ozone precursors had little chance for dilution and were available for ozone production.

Kansas City-As with St. Louis, the presence of multiple frontal boundaries in the region typically leads to little or no formation of ozone. However, on the days with reported ozone exceedances, the frontal systems were in close proximity to one another and often trapped pollutants between their boundaries. With little or no precipitation reported and sunny skies, the ozone precursors had little chance for dilution and were available for ozone production.

Meteorological Regime #6

Synoptic Features

Regime #6 resulted in a high pressure buildup over West Virginia as a stationary front remained in an east/west configuration along the I-70 corridor. The frontal boundary advanced and retreated across the immediate area causing ozone episodes with significant differences in ozone maximums from day to day depending on what air mass was over each metropolitan area.

Surface Features

St. Louis-The presence of the frontal boundary to the north or the south of the city caused the wind speeds and directions to vary from day to day depending upon the air mass over the region.

Kansas City-The presence of the frontal boundary to the north or the south of the city caused the wind speeds and directions to vary from day to day depending upon the air mass over the region. In most instances, a wind shift was present.

Meteorological Regime #7

Synoptic Features

Regime #7 occurs when an area of strong high pressure develops over the Eastern United States. Depending on the strength of the high pressure region, centers may develop over Missouri and Illinois. The strongest subsidence regions remain over the East Coast. The St. Louis region was the only area within the State of Missouri that reported ozone exceedances during this meteorological regime.

Surface Features

St. Louis-The presence of the high pressure centers throughout the region leads to calm conditions during the morning hours allowing precursor emissions to remain in the urban core. As the high pressure centers migrate and/or weaken as the day continues, the ozone plume will begin to migrate in the direction of the surface flow. The wind directions vary under this regime and are extremely dependent upon the development and position of individual high pressure centers.

Meteorological Regime #8

Synoptic Features

Regime #8 occurs when frontal boundaries establish themselves over eastern Kansas as high pressure builds over the Ohio River Valley. As the high pressure area continues to take hold, the front will be forced southward into the Gulf of Mexico. The Kansas City region was the only

area within the State of Missouri that reported ozone exceedances during this meteorological regime.

Surface Features

Kansas City-The presence of the high pressure center over the Ohio River Valley during the morning hours often leads to southeasterly flow over the Kansas City region with morning wind speeds less than ten knots. The afternoon flow often increases to the low teens.

METEOROLOGY AND SEVERITY/FREQUENCY OF OZONE EPISODES

The number of monitor sites exceeding 85 parts per billion, and the relative concentration reported at each site revealed that the severity and frequency of each ozone event differed from Kansas City to St. Louis. Additionally, when each day was placed within its meteorological regime it was noted that although the regimes overlap, the synoptic pattern leading to the most frequent and severe ozone concentrations also varied across the state, see Appendix A - Table 3.

The meteorological conditions associated with Regime's #2, #4, and #7 resulted in the most severe 8-hour ozone concentrations within the St. Louis Region. Each of these meteorological regimes resulted in days exceeding 110 parts per billion based upon the 8-hour average. Regime's #1 and #3 were the next most severe, with concentrations exceeding 100 parts per billion at several ambient air quality sites. Both regimes #6 and #7 remained below 100 parts per billion.

In contrast, the meteorological conditions associated with Regime's #2 and #6 resulted in the most severe 8-hour ozone concentrations observed throughout the Kansas City region. Each of these meteorological regimes resulted in several days exceeding 100 parts per billion based upon the 8-hour ozone average. The remaining regimes all reported concentrations less than 100 parts per billion.

In addition to reviewing the severity of ozone concentrations under certain meteorological conditions, the likelihood that ozone concentrations in excess of the 8-hour ozone standard would occur was also evaluated. In the St. Louis region, Regime's #1 and #2 occurred most frequently and often were associated with the same episode. Regimes #3, #4, and #7 also occurred on a regular basis, with Regime #3 ending ozone episodes with the passage of a frontal system that ushered in new, cleaner air masses.

Unlike St. Louis, the frequency study indicated that Regime's #2 and #6 occurred most frequently within the Kansas City region. Regimes #1 and #3 also occurred on a regular basis as the passage of frontal boundaries brought in new cleaner air masses.

The meteorological conditions that lead to elevated ozone concentrations in the St. Louis and Kansas City region's vary with the most notable difference being the relative wind speeds. Often times, St. Louis comes directly under the influence of the Bermuda high that moves inland by mid-July. As the distance from the center of the high pressure

center increases, the winds blow more rapidly from Central Missouri westward. Again, the position of the synoptic scale features played a role in determining what regimes caused ozone concentrations in Kansas City and St. Louis.

TRAJECTORY ANALYSIS

Trajectory plots present an aerial view of the path an air parcel travels both horizontally and vertically, before reaching its final destination. Two kinds of trajectory plots, backward and forward, were used to evaluate ozone exceedances in the Kansas City and St. Louis metropolitan areas. Kansas City area exceedance days were evaluated using backward trajectory plots while St. Louis area exceedance days were evaluated using forward trajectory plots. Meteorological dynamics cause air to rise or fall, and in turn, determining its path can affect air quality by carrying air pollutants many miles from their sources. These observations of air movements are important in understanding where air pollution impacts will occur and the sources of pollution that cause elevated concentrations. This evaluation was conducted on days during 2000, 2001, and 2002 with 8-hour ozone exceedances. A very similar evaluation was conducted for exceedance days during 1996-98 and included in the July 2000 submittal.

Backward Trajectory Analysis

The backward trajectory is an evaluation of an air parcel's course of travel over a specified amount of time prior to arriving at a particular location (in this case, Kansas City). Five locations were selected from which back trajectories were initiated. The locations selected were: *Watkins Mill State Park, Liberty, KCI Airport, Worlds of Fun, and Rocky Creek* (all located in Missouri). All these sites are included in Figure 1, Monitoring Locations in the Kansas City Area. The back trajectories were calculated for days where ozone concentrations exceeded 85 ppb and were evaluated over a period of 12 hours before the highest 1-hour concentration was monitored. The meteorological data used in this evaluation was surface wind speed and direction data from the Kansas City International Airport. In Appendix A, Figures 1-6 contain this information for Kansas City. Figures 1-3 illustrate the exceedance days from 1996-98 included in the July 2000 submittal and include information for Watkins Mill, Worlds of Fun, Liberty and KCI. Figure 1 provides only the trajectory information for each day. Figure 2 provides information related to the VOC point sources in the area as well as the trajectory information. Similarly, Figure 3 illustrates NOx point source and trajectory information. Figure 4 (only trajectory data), Figure 5 (VOC emission/trajectory information), and Figure 6 (NOx emission/trajectory information) contain the 2000-02 exceedance day analysis. The sites included in this analysis were Watkins Mill, Worlds of Fun (2000-01), Liberty, KCI, and Rocky Creek (2002).

Forward Trajectory Analysis

Similarly, the forward trajectory is an evaluation of an air parcel's course of travel over a specified amount of time. Although, the evaluation of an air parcel's course of travel is plotted for a specified time period starting at a specified location (St. Louis, in this case) and follows the path it will take as time progresses. Forward trajectories were evaluated over a time period of 24 hours for days that had ozone exceedances equal to or greater than 85 ppb. The ambient air quality monitors used were located at 21 sites located across the St. Louis metropolitan area. Those sites include: *Arnold, Mark Twain State Park, West Alton, Orchard Farm, Bonne Terre, S. Lindbergh, Queeny Park, Ladue, Ferguson, St. Ann, S. Broadway, Clark, and Margaretta* (all located in Missouri). On the Illinois side of the St. Louis area, sites include: *Alton, Maryville, Edwardsville, Wood River, East St. Louis, Houston, Nilwood and Jerseyville.* The Hybrid Single-Particle Langrangian Integrated Trajectory (HYSPLIT) model was used to develop the forward trajectory plots for this study.

Meteorological Dataset

The HYSPLIT model allows the user to specify the type of meteorological dataset that will be used to compute the trajectory plots. When choosing archived data, the user has several options:

- **EDAS Data*** -Covers the continental United States after 1997 with a horizontal resolution of 80 kilometers.
- **NGM Data** -Covers the continental United States prior to 1998 with a horizontal resolution of 180 kilometers.
- **FNL Data** -Covers both hemispheres with a horizontal resolution of 191 kilometers.
- **Reanalysis Data** -Covers the continental United States from the mid-1940's to the end of 1999 with a coarse horizontal grid resolution.

In order to obtain the best results, the most refined dataset was utilized. For the Kansas City events, local surface data from the Kansas City International airport (wind speed, wind direction) was used in determining the trajectory plots. The St. Louis events were analyzed differently in order to obtain more precise trajectory plots. It is important to look at various heights when producing trajectory plots because variations of wind speed and direction can occur from the ground level into the higher altitudes. A depiction of the vertical structure of the atmosphere is necessary to accurately determine pollutant transport within the boundary layer. Thus, data for the St. Louis plots came from EDAS Data* and were plotted at 1000mb, 925mb and 850mb (or ~500, ~1000, and ~1500 meters above ground level).

Meteorological data for the St. Louis trajectories was obtained from the HYSPLIT model, and meteorological data for the Kansas City trajectories was obtained from the National Weather Service.

Trajectory Direction

The trajectory direction identifies the direction for which the trajectory calculation will be made. Again, for Kansas City events, *backward* trajectories were used in determining where the air parcels originated. For St. Louis, *forward* trajectories were used to identify the air parcel's path that it took from the St. Louis core emission area.

Start Time

Backward trajectory calculations start at the end of the forecast period that we are interested in analyzing. For Kansas City trajectories, the length of time is 12 hours. Forward trajectory calculations start at the beginning of the forecast period that we are interested in analyzing. For St. Louis trajectories, the length of time is 24 hours.

Conclusions

Kansas City-The back trajectory analysis performed for the Kansas City area suggests that winds are primarily from the east-southeast to the southwest when higher concentrations are recorded at the monitoring stations included in the analysis. It is interesting to note that most of the trajectories travel through the Kansas City emission core area (one or more of Jackson, Wyandotte (KS), and Johnson (KS) counties). Counties to the north of the Kansas City area (Buchanan, Clinton, Caldwell, and Ray) are less likely to contribute, frequently, to the ozone problem in Kansas City. In contrast, counties to the south are more likely to contribute to ozone formation (Cass, Miami (KS), Linn (KS), Henry, Johnson (MO)).

St. Louis-The forward trajectory analysis for the St. Louis area shows that the wind directions associated with high ozone values are of southeasterly, easterly, southerly, and southwesterly components. The predominant pattern is exceedances at sites that are downwind of the metropolitan area or exceedances at nearly all the sites within the monitoring network (most likely stagnation events). Only a few days (≤ 3) saw exceedances greater than the standard in "out-state" locations (i.e. Mark Twain State Park). Incoming air pollution from southern Missouri, southern Illinois, western Kentucky, and Tennessee area also can play a significant role in 8-hour ozone concentrations in the St. Louis area with some exceedances reported south of the St. Louis City area when winds are from the south and southeast.

The differences in severity and frequency of ozone exceedances between the St. Louis and Kansas City regions is important to note because the effectiveness of control strategies on baseline concentrations will vary based upon the conditions that lead to ozone formation. The results obtained from the regime analysis, in conjunction with the trajectory analysis, will allow the Department's Air Pollution Control Program to assess the potential for ozone and its transport to other regions, and in the selection of photochemical modeling episodes.

WINDROSE EVALUATION

In order to understand typical wind direction and speeds in the Kansas City areas, wind rose plots were constructed for the peak ozone months of June, July and August, for the time period 2000 – 2002. The meteorological station used is located at Kansas City International Airport. The months of the year for elevated 8-hour ozone formation in St. Louis appear to be somewhat different than Kansas City. In St. Louis, it is more likely that high 8-hour ozone concentrations will be monitored during the he entire ozone season (April – October). Therefore, the wind rose for St. Louis was created using 1995-99 data, since the information for the entire ozone season was readily available for this time frame. The meteorological station used for St. Louis was Lambert International Airport. All this information was provided by the NOAA National Data Center (NNDC).

A windrose was developed for St. Louis and Kansas City for all hours, 7-10 AM, and 1-4 PM. The two specific time frames are typically the maximum emission hours for ozone precursors that contribute to high ozone formation (morning rush hour 7-10) and the time when solar radiation is highest and causes elevated ozone concentrations.

Kansas City, primarily had winds predominantly from the south for all analyses (7-10 AM, 1-4 PM, and all hours). This is very similar to previous analyses conducted by the APCP and illustrates a pattern of high ozone to the north of the metropolitan core region. Conversely, St. Louis had winds with primarily southerly, westerly, and easterly components during the morning hours and then a slightly larger northerly component in the afternoon time frame. This could be partially due to frontal passages occurring during the afternoon hours across the area. The all hours wind rose for St. Louis still shows a predominantly southerly wind component as has been seen in previous analyses. The average wind speeds were calculated to be between eight and nine knots for both Kansas City and St. Louis.

Kansas City MSA

CURRENT AIR QUALITY

The current and recent past air quality information for 8-hour ozone in the Kansas City MSA is shown in Tables 1 and 1B. The design value for 8-hour ozone in any area is based on the highest average of the 4th highest values at all monitors. Figure 1 denotes the locations of the monitors within the current Kansas City ozone network.

TABLE 1

Monitor	4th High 8-hour Ozone Values (ppb)							
	1995	1996	1997	1998	1999	2000	2001	2002
Liberty	99	87	98	95	82	91	79	87
Watkins Mill	96	83	95	91	84	84	73	83
KCI	90	80	90	90	76	90	79	85
Worlds of Fun	88	72	82	86	82	88	77	-
Richards Gebaur	77	71	72	73	81			
Richards Gebaur South						84	72	73
Rocky Creek								91
Wyandotte Co. (KS)	89	86	81	87	78	87	76	81*
El Dorado Springs				87	84	94	74	82
Mine Creek (KS)				80	82	81	76	72*

*Through September 30, 2002

TABLE 1B

Monitor	95-97	96-98	97-99	98-00	99-01	00-02
	Average	Average	Average	Average	Average	Average
Liberty	**94**	**93**	**91**	**89**	84	**85**
Watkins Mill	**91**	**89**	**90**	**86**	80	80
KCI	**86**	**86**	**85**	**85**	81	84
Worlds of Fun	80	80	83	**85**	82	-
Richards Gebaur	73	72	75			
Richards Gebaur South						79
Rocky Creek						**91****
Wyandotte Co. (KS)	**85**	84	82	84	80	81
El Dorado Springs				**88**	84	83

Mine Creek (KS)				81	79	76

BOLD denotes monitors that exceed the 85 ppb cutoff
**2002 Data Only at Rocky Creek

The Worlds of Fun monitor was relocated to Rocky Creek during an 8-hour ozone network review to gather information regarding ozone concentrations to the north of the downtown area. One of the reasons for this move was the predominant wind direction in the Kansas City area is due south.

The Kansas City area does not meet the 8-hour standard based on the 2000-02 ozone design values. The design value for Kansas City is 85 ppb (measured at the Liberty monitor). The Liberty monitor is the only site with a design value over the 8-hour ozone NAAQS. However, the 2002 4th highest concentration at the new Rocky Creek site was 4 ppb higher than the Liberty site (87 vs. 91). The violating county in the Kansas City MSA is Clay. It should be noted that during the 1999-01 period none of the monitoring sites in the Kansas City area violated the 8-hour ozone standard. The 1998-00 period exhibited violations of the 8-hour standard for 4 monitoring sites in the Kansas City area. Additional ozone monitoring data was collected to the north of Kansas City during 2001. Both activities occurred due to Prevention of Significant Deterioration permit applications in the area. One set was collected in Savannah, Missouri (about 20km north of St. Joseph). The results of this analysis showed a maximum 8-hour ozone concentration of 79 ppb and a 4th high concentration of 72 ppb. The other was collected in DeKalb, Missouri in southern Buchanan county. The maximum 8-hour ozone concentration was 82 ppb and the 4th high concentration was 79 ppb. No exceedances of the 8-hour standard were observed at either location.

The nearby, upwind MSAs of interest are Springfield, MO; Joplin, MO; Tulsa, OK; Wichita, KS; and Lawrence, KS. The Springfield MSA has 1999-01 design value of 73 ppb and 2000-02 design value of 76 ppb. The Wichita MSA has 1999-01 and 2000-02 design values of 81 ppb. The Tulsa MSA has 1999-01 and 2000-02 design values of 90 ppb. No ozone monitoring data exists for Lawrence, KS or Joplin, MO.

KANSAS CITY AREA POINT SOURCE EMISSION, POPULATION, AND TRAFFIC INFORMATION

Table 2 illustrates the precursor emissions and population data for the counties in and surrounding the Kansas City MSA. This data illustrates that the five counties in the 1-hour maintenance area account for the vast majority of point source VOC and NOx emissions within the MSA for Kansas City (93% VOC and NOx). Among the remaining counties in the MSA, Miami County has the most emissions from point sources of VOC and NOx. Figures 2, 3, and 4 illustrate the location of the point sources in these counties. Figure 2 contains all sources of VOC and NOx in the area. Figure 3 provides information about sources greater than 25 TPY of VOC emissions. Figure 4 has information concerning NOx sources with emissions greater than 25 TPY. These figures illustrate the same pattern as the tables with some exceptions (most of the emission sources in the

MSA are in the existing maintenance area). The surrounding counties in Missouri that have greater than 5% of the MSA total of either NOx or VOC point source emissions are Buchanan, Pettis, and Henry. Douglas and Linn counties in Kansas also meet this criteria.

Table 3 contains county-by-county summary emission data for Missouri counties in the Kansas City area. This summary contains point, area, and mobile source (not non-road mobile) emission inventory data for all the counties in the area. This information is provided for reference only with respect to the Missouri counties and can be used for informational purposes. The same level of information was not available for inclusion from the Kansas counties outside the maintenance area.

The population data for 2000 in Table 2 shows that six of the eleven MSA counties exceed 70,000 people. These counties include the 5 maintenance area counties and Cass county. The population growth information from 1990-2000 is also of interest for several of these counties. Johnson (KS), Cass, and Platte counties have the highest population growth rates for the area. The surrounding counties with "high" populations include Buchanan and Douglas (Douglas also has a 20% population growth rate). Figure 5 provides 2000 population density information for many of the counties in the area. This illustrates the strong signal of high population and urbanization within the maintenance area with some areas of high density in Douglas, Cass, Buchanan, and Leavenworth counties. Figure 6 illustrates the incorporated areas near Kansas City. This map shows the counties outside the 5-county maintenance area are less urban than the 5-county area. Special note should be taken of northern Platte (rural), eastern Leavenworth, and extreme northern Cass counties as exceptions to the previous statement.

The Vehicle Miles Traveled (VMT), traffic count, and commuter pattern information for this analysis has been provided by the Mid-America Regional Council (MARC), the Missouri Department of Transportation (MoDOT), the Kansas Department of Transportation, and the U.S. Census Bureau. The VMT information demonstrates the typical pattern of high urban core VMT with major highways (I-29, 35, 70, and 435) contributing the majority of that VMT. Figure 7, 8, and 9 show the traffic patterns based on MoDOT data (Figure 7), the MARC traffic network (Figure 8), and the whole region (Figure 9). The VMT data, as shown in Table 2, illustrates a consistently higher density and volume of VMT in the urban core counties with the major highways contributing in the outlying counties of the MSA.

The Kansas City 1-hour maintenance area (Platte, Clay, Jackson, Wyandotte (KS), and Johnson (KS)) have specific fuel requirements for control of VOC emissions. The applicable state regulations require 7.0 Reid Vapor Pressure (RVP) gasoline. The Missouri regulation is 10 CSR 10-2.330. There are several other point and area source regulations in place in the Missouri portion of the maintenance area:

1) aerospace manufacturing/rework 10 CSR 10-2.205,
2) solvent metal cleaning 10 CSR 10-2.210,
3) solvent cleanup operations 10 CSR 10-2.215,

4) liquified cutback asphalt 10 CSR 10-2.220,
5) industrial surface coating 10 CSR 10-2.230,
6) petroleum storage/transfer (Stage I) 10 CSR 10-2.260,
7) rotogravure/flexographic printing 10 CSR 10-2.290,
8) manufacturing of paint, laquer, varnish, enamels 10 CSR 10-2.300,
9) application of automotive underbody deadeners 10 CSR 10-2.310,
10) pesticide and herbicide production 10 CSR 10-2.320,
11) lithographic printing 10 CSR 10-2.340,
12) bakery ovens 10 CSR 10-2.360.

All these VOC emission reduction regulations are included and detailed in the latest revision to the Kansas City 1-hour ozone maintenance plan. Also, the state of Missouri has submitted a State Implementation Plan (SIP) with utility control in the western two-thirds of the state at 0.35 lb NOx/MMBTU heat input. This NOx control effort should lead to decreased ozone concentrations in the region and, specifically, in Kansas City. Based on the ozone monitoring data and the patterns of exceedances in Missouri, the need for reducing incoming ozone and precursor boundary concentrations to our metropolitan areas is straightforward. Ultimately, exceedances of the 8-hour standard are more susceptible to these concentrations than exceedances of the 1-hour standard. Therefore, all efforts to reduce incoming polllution will result in downwind air quality improvements.

METEOROLOGICAL IMPACTS IN KANSAS CITY

When viewing all the meteorological information for Kansas City (the regime analysis, the back trajectory analysis, and the windroses) the most significant conclusion is that winds with a strong southerly component are predominant (south-southwest to southeast) are typically present when Kansas City has high 8-hour ozone concentrations. The regime analyses illustrates the dependence on the presence of frontal boundaries or a high pressure center in or near Missouri on high ozone concentrations in Kansas City.

One other analysis that was conducted was to evaluate the number of 8-hour exceedances within the last four years to ascertain where the high ozone concentrations are occurring within the Kansas City area. This information is included in Appendix A – Table 4. The number of monitors within the Kansas City network makes this evaluation less compelling. The geographic coverage of the area is not outstanding, but does provide some information for potential trend development. The Liberty monitor has the largest number of 8-hour ozone exceedances during 1999-2002 with 17. KCI experienced 11 exceedances and Watkins Mill had 9 exceedances over the same time frame. Rocky Creek experienced 10 exceedances in 2002 (next highest was 5 at Liberty). Richards Gebaur and Richards Gebaur South monitored a combined 6 exceedances. The only other site of interest was the El Dorado Springs site that monitored 13 exceedances most of which occurred in 1999. This pattern of exceedances follows the trend of southerly wind directions for the most part (more exceedances at Liberty/Rocky Creek than Richards Gebaur). The Wyandotte County (KS) monitor and the Worlds of Fun monitor

have exhibited a pattern of exceedances under stagnation or light and variable wind conditions. These two sites monitored fewer exceedances than the monitors listed above.

The information regarding El Dorado Springs provides uncertainty about the location of the source areas that impact this particular monitor. In fact, the impacts at El Dorado Springs may be the result of several different source areas (Kansas City, Springfield/Joplin, Tulsa or other areas to the south).

URBANIZATION AND OTHER INFORMATION REQUESTED IN THE EPA GUIDANCE

One jurisdictional boundary of interest is the current 5-county maintenance area. The MPO boundary is also of interest because of its urban nature and higher expected growth rates for Kansas City (VMT, population, etc.). This boundary is illustrated in Figure 10.

As seen in Table 2, population growth above 15% has occurred in the following counties between 1990-2000: Cass, Jackson, and Platte in Missouri and Douglas, Miami, Jefferson, and Johnson in Kansas. Additional growth information is presented in Table 4. This information includes population and employment projections until 2020 based on 1990 census information for some of the counties in the area. Additional growth is expected to occur within the entire Kansas City area except population within Wyandotte county. The highest growth is expected to continue to occur within Johnson (KS), Platte, Cass, and Douglas (KS).

Employment data for 2000 was also incorporated into Table 2. This data can provide a better understanding of counties with small populations that have more industrial/commercial activity with the metropolitan area. Over 94 percent of the MSA workforce is employed in the current maintenance area. Buchanan and Douglas (KS) counties have the highest percentage of employees (4.2%) outside the MSA with Leavenworth (KS) and Cass having the next highest percentage (1.7%). Of these counties, the employment information suggests a higher percentage of Cass and Leavenworth residents travel to another county within the area (higher population percentage/lower employment percentage).

There are no significant geographic or topographic features in the Kansas City area.

The final piece of "connectivity" information is the workplace/resident relationship data from the 2000 census released in March 2003. Table 5 contains the raw data for the Kansas City area. This table is a matrix of residence versus employment location. For example, the number of people that live in Jackson County and work in Clay County can be determined. Several important pieces of information can be gained from review of this data.

1) The vast majority of employed people who live in the current 1-hour maintenance area work in the maintenance area (minimum 94.4% Platte, maximum 97.3% Jackson).
2) The vast majority of employed people who live in the MSA work in the MSA (Clinton only county less than 90%).
3) Cass county is the most connected of the MSA counties to the maintenance area (61% of the 40,755 employed persons in Cass work in the maintenance area).
4) Miami (KS) and Ray counties also have greater than 50% of their employed residents working in the maintenance area. However, the total number of employees is less than 7,000 per county.

SUMMARY

The following table is a condensed summary of 8-hour ozone designation factors for counties generally within one county of the MSA. Table 2 presented much of this same information for the initial screening of counties. This table can be used as a guide for selecting counties with greater opportunity to contribute to 8-hour ozone significantly in the Kansas City area. To reiterate, the Clay County is the only county that has a monitor which violates the 8-hour ozone standard for the 2000-02 design value period. The focus of Table 6 is to present as comprehensive evaluation as possible using objective metrics that (for all counties) can be used to address the emission and urbanization components of the boundary guidance.

Table 6: Summary of 8-Hour Designation Factors

County	1-Hr. Maint Area/MSA	2000 Pt. Source VOC % (TPY)	2000 Pt. Source NOx % (TPY)	2000 Pop. % (1000)	1999/2000 Daily VMT % (1000)	2000 Population Density	Total Non-Met Summary
Jackson	Yes/Yes	19.3 (1910)	21.1 (18423)	32.1 (655)	30.2 (18539)	16.9	119.3
Wyandotte (KS)	Yes/Yes	21.7 (2153)	8.6 (7483)	7.7 (158)	7.6 (4668)	16.3	67.6
Johnson (KS)	Yes/Yes	7.5 (746)	1.7 (1487)	22.1 (451)	21.6 (13290)	14.8	61.9
Clay	Yes/Yes	24.2 (2397)	0.9 (815)	9.0 (184)	10.3 (6317)	7.3	51.6
Linn (KS)	No/No	3.0 (300)	38.2 (33330)	0.5 (10)	0.6 (342)	0.2	42.5
Buchanan	No/No	10.0 (988)	4.3 (3758)	4.3 (86)	3.1 (1916)	3.3	24.9
Platte	Yes/Yes	4.0 (401)	7.1 (6183)	3.6 (74)	5.1 (3159)	2.7	22.6
Douglas (KS)	No/No	1.4 (140)	8.5 (7443)	4.9 (100)	3.9 (2412)	3.4	22.2
Henry	No/No	2.3 (231)	6.5 (5648)	1.1 (22)	1.4 (851)	0.5	11.8
Cass	No/Yes	0.9 (86)	0.1 (84)	4.0 (82)	4.4 (2681)	1.8	11.1
Leavenworth (KS)	No/Yes	0.7 (69)	0.1 (69)	3.4 (69)	2.3 (1424)	2.3	8.7
Miami (KS)	No/Yes	1.4 (141)	2.6 (2267)	1.4 (28)	1.8 (1094)	0.8	7.9
Lafayette	No/Yes	1.9 (190)	0.1 (62)	1.6 (33)	3.2 (1955)	0.8	7.6
Johnson	No/No	0.9 (91)	0.1 (88)	2.4 (48)	2.3 (1402)	0.9	6.6
Atchison (KS)	No/No	2.2 (219)	0.4 (365)	0.8 (17)	0.6 (344)	0.6	4.6
Franklin (KS)	No/No	0.2 (23)	0.2 (192)	1.2 (25)	1.7 (1020)	0.7	4.0
Clinton	No/Yes	0.4 (42)	0.0 (1)	0.9 (19)	1.5 (918)	0.7	3.5
Ray	No/Yes	0.3 (25)	0.0 (14)	1.1 (23)	0.8 (497)	0.6	2.9

**The VMT for the maintenance area is based on 1999 MARC information, the remaining counties in Kansas are 2000 VMT from KDOT, and the Missouri surrounding counties are 1999 VMT from MoDOT*

Percentages in Table 6 are based on MSA totals plus Linn (KS), Douglas (KS), Buchanan, Henry, and Johnson counties. These additional counties were included to provide a complete emission inventory and VMT snapshot of the region. In addition, these counties border the existing MSA counties in several directions.

The population density metric is based on population/total county acreage * 10. This metric delivers a degree of urbanization to the summary. Due to the lack of emissions, population, and/or VMT, the following counties will receive no additional detailed analysis with respect to contribution to nonattainment: Ray, Clinton, Franklin (KS), Atchison (KS), Johnson (MO), and Lafayette.

The meteorology of ozone formation in Kansas City should be factored into this summary in, at least, a qualitative fashion. As discussed above, the wind conditions associated with high ozone concentrations are easterly to southwesterly flows. This suggests less consideration should be given to Buchanan and Leavenworth counties. In addition, Buchanan county is somewhat distant and isolated from the metropolitan area. Also, monitoring data south and north of St. Joseph (major city in Buchanan) demonstrated no exceedances of the 8-hour ozone standard.

Cass, Douglas (KS), Miami (KS), Henry, and Linn (KS) are the remaining counties to the south and southwest of the metropolitan area. These counties must be given close consideration due to the "normal" transport directions for Kansas City. It should be noted that Douglas county does not represent a significant transport direction in the back trajectory analysis discussed above and is likely too distant from the core metropolitan area to contribute frequently to high ozone concentrations. However, there is reason to believe that Douglas county could contribute to high ozone in the future especially since the population of Douglas county is 99,962 and its population growth was 22% from 1990 to 2000. The size of the NOx emissions from the La Cygne power plant in Linn county are a concern for ozone formation in the Kansas City area. These emissions were approximately 90 TPD in 2000 and are located directly south of the metropolitan area (in the primary wind direction upwind of Kansas City). While Linn county does not have significant population, VMT, and is likely rural in nature, the size of this source must be accounted for in this analysis. In the same manner as Linn, Henry county is rural in nature and has a small population and VMT with a low percentage of workers commuting to the MSA, but has some large point source emitters that could raise concern about its downwind ozone impact on Kansas City. The major NOx source in Henry county is the Montrose power plant. This source, as well as the other power plants in the western two-thirds of Missouri, is subject to Missouri's statewide NOx rule (10 CSR 10-6.350) with a limit based on 0.35 lb/MMBTU for this plant.

Miami county does not have any large contributing factors and is very rural in nature. One of the main reasons for consideration given to this county would be the 2,267 TPY of NOx emissions in 2000. The continued population growth of Miami county could be a concern as well. In addition, it is part of the MSA, is strongly dependent on the core area for employment, and is "upwind" of the area. However, the technical evidence supports the fact that Miami does not contribute as frequently to 8-hour ozone exceedances in the

Kansas City area as the metropolitan area. Cass county is also upwind of the area and is part of the MSA. The point source emissions from Cass are insignificant and do not support significant contribution to the Kansas City area ozone problems. However, the VMT, population, and growth of northern Cass county are more supportive of this type of contribution in the future. There is a significant decline in urbanization near the MPO boundary as well as a decline in population density and VMT. Also, the commuting patterns are such that a large percentage of Cass county residents commute to the metropolitan core for work. In the same manner as Linn county, Cass county (at least very northern Cass) should be considered as a possible significant contributor to 8-hour ozone formation in Kansas City.

Conversely, northern Platte county is very rural and the meteorological evaluation shows limited evidence to suggest Platte county has frequent contributions to 8-hour exceedances. However, Platte county does have significant point source NOx emissions in the northern half of the county. Nonetheless, Platte county contributes the least to ozone in the current 1-hour maintenance area.

Based on Table 6, there are several conclusions that can be drawn from the data. Jackson, Wyandotte, Johnson (KS), and Clay counties contribute the most to ozone in Kansas City. Then, there is a significant drop-off in potential contribution to Linn, Buchanan, Platte, and Douglas counties. These counties are less likely to contribute frequently and significantly to ozone in Kansas City. However, they will contribute under certain meteorological conditions. The meteorological analyses indicate that Buchanan and Douglas counties are less likely than the other two. Another county of interest would be Cass due to "upwind" status and significant VMT/population (especially inside the MPO boundary).

COUNTY BY COUNTY SUMMARY

The following is a county-by-county summary of factors that were considered in the inclusion/exclusion evaluation for the Kansas City 8-hour ozone nonattainment area. These factors include precursor emissions, air quality data, population, population density/urbanization, traffic patterns/connectivity, meteorology, growth, and jurisdictional boundaries. In addition, if special consideration should be given to some additional factors (i.e. location of emission sources in the county or distance from the core metropolitan area) this is, also, presented. All factors in the EPA guidance were considered, but some were considered as a group (e.g. maintenance area VOC controls) earlier in the document. NOTE: the definitions for the descriptive terms used in this summary are contained in Table 13.

Jackson County

1) Large point source emissions of NOx (18,423 TPY) and VOC (1,910 TPY)
2) No current ozone monitoring in Jackson County, previously low design values monitored in extreme southern portion of the county (Richards Gebaur)
3) Largest population in the area (654,880)

4) Greatest population density in the area (1.7 people/acre), highly urbanized county
5) Largest VMT in the area (18,539,255) and part of the metropolitan complex
6) Meteorological analysis is supportive of contribution
7) Limited population growth (3% from 2000-2020)
8) Located in current 1-hour maintenance area and MSA

Wyandotte County (KS)

1) Large point source emissions of NOx (7,483 TPY) and VOC (2,153 TPY)
2) One ozone monitor (Wyandotte Co.) with an 8-hour design value of 81 ppb
3) Large population (157,882)
4) Second highest population density in the area (1.6 people/acre), highly urbanized county
5) Large VMT (4,668,108) and part of the metropolitan complex
6) Meteorological analysis is supportive of contribution
7) Population reduction predicted by 2020 (-9%)
8) Located in current 1-hour maintenance area and MSA

Johnson County (KS)

1) Large point source emissions of NOx (1,487 TPY) and VOC (746 TPY)
2) No ozone monitoring in Johnson County prior to 2003 ozone season
3) Large population (451,086)
4) Third highest population density in the area (1.5 people/acre), highly urbanized county
5) Large VMT (13,289,730) and part of the metropolitan complex
6) Significant population and employment growth expected (35% population growth by 2020)
7) Meteorological analysis is supportive of contribution
8) Located in the current 1-hour maintenance area and MSA

Clay County

1) Large point source emissions of VOC (2,397 TPY) and NOx (815 TPY)
2) Currently monitoring 8-hour ozone violation at Liberty site (design value – 85 ppb) with high concentrations at Rocky Creek site (4^{th} high of 92 ppb in 2002), but less than 3 years of data
3) Large population (184,006)
4) Fourth highest population density (however, less than 1 person per acre - 0.7), urbanized county
5) Large VMT (6,317,145) and southern portion of the county is part of the metropolitan complex
6) Fairly high population growth (22% by 2020) especially with the magnitude of the original population
7) Meteorological analysis is supportive of contribution
8) Located in the current 1-hour maintenance area and MSA

Linn County (KS)

1) Very large point source NOx emissions (33,330 TPY or over **90** TPD), but small VOC emissions (300 TPY)
2) Ozone monitoring data at Mine Creek site has a design value of 72 ppb
3) Very small population (9,570)
4) Lowest population density in the area, with extremely limited urbanization
5) Small VMT (342,917) with no strong commuter linkage to the metropolitan area
6) Population growth of 18% by 2020, but original population is very small
7) Meteorological analysis is supportive of contribution (primary source is directly south of the metropolitan core and southerly winds are, by far, the most predominant in KC)
8) Not part of the Kansas City MSA or maintenance area and 85 km from the downtown Kansas City area

Buchanan County

1) Large point source emissions of NOx (3,758 TPY) and VOC emissions (988 TPY)
2) Previous ozone monitoring data showed no exceedances of the 8-hour standard (1-year of sampling)
3) Medium population (85,998)
4) Low population density (0.3 people/acre), with urbanization in and around the city of St. Joseph
5) Medium VMT (1,915,642) with no strong commuter linkage to the other counties in the maintenance area
6) Projected population decrease by 2020 of 3%
7) Meteorological analysis is not supportive of frequent contribution
8) Not part of the Kansas City MSA or maintenance area, part of the St. Joseph MSA and is 65 km from the downtown Kansas City area

Platte County

1) Large point source NOx emissions (6,183 TPY) and medium point source VOC emissions (401 TPY)
2) KCI monitoring site has an 8-hour design value of 84 ppb and has monitored violations in 3 of the last 5 averaging periods
3) Medium population (73,781)
4) Low population density (0.2 people per acre), but southern portion of the county is part of the contiguous metropolitan area with significant urbanization
5) Large VMT (3,159,378), strong commuter linkage to other counties in the metropolitan complex
6) Population growth is expected to continue with 34% growth by 2020 (largely in the southern portion)
7) Meteorological analysis offers limited support to contribution from northern Platte county
8) Located in the current 1-hour maintenance area and MSA

9) Statewide utility NOx rule would control the largest NOx source in this county to 0.35 lb NOx/MMBTU

Douglas County (KS)

1) Large point source NOx emissions (7,443 TPY), but small point source VOC emissions (140 TPY)
2) No ozone monitoring conducted prior to 2003 ozone season
3) Large population (99,962)
4) Low population density (0.3 people per acre), but urbanization around the city of Lawrence
5) Medium VMT (2,411,839), no strong commuter linkage to the metropolitan area
6) Considerable growth (employment and population) expected, population growth of 39% by 2020
7) Meteorological analysis offers limited support for contribution
8) Not part of the maintenance area or MSA, separate MSA (Lawrence, KS) about 50 km from the downtown Kansas City area

Cass County

1) Very limited point source VOC (86 TPY) and small NOx (84 TPY) emissions
2) Richards-Gebaur monitoring site (formerly southern Jackson county and currently in northern Cass county) monitors lowest of any sites in the network and is directly "downwind" of Cass under predominant wind direction
3) Medium population (82,092) – approx. (45,000 inside MPO boundary)
4) Low population density (0.2 people per acre), but northern portion of the county is part of the contiguous metropolitan area with significant urbanization and higher population density
5) Medium VMT (2,680,904) with about 38% of VMT within the MPO boundary and strong commuter linkage to the other counties in the maintenance area (61% of employed residents work in the maintenance area)
6) Reasonable employment and population growth expected, mainly in the MPO portion of the county (total population growth 39% by 2020)
7) Meteorological analysis is supportive of contribution
8) Located in the MSA, but not part of the 1-hour maintenance area, northern portion of county is part of the contiguous metropolitan area (MPO)

Leavenworth County (KS)

1) Small point source VOC (69 TPY) and NOx (69 TPY) emissions
2) No monitoring sites prior to 2003 ozone season
3) Medium population (68,691)
4) Population Density – 0.23 people per acre, but higher population density, urbanization, and employment in the northeastern portion of the county (near Leavenworth, KS)

5) Small VMT (1,424,245) with slight commuter linkage with Jackson, Johnson, and Wyandotte counties
6) Reasonable growth expected (25% population growth by 2020)
7) Meteorological analysis not supportive of frequent contribution
8) Located in the MSA and MPO, not the current 1-hour maintenance area

Henry County

1) Large point source NOx emissions (5,648 TPY), but small point source VOC emissions (231 TPY)
2) No ozone monitoring data collected
3) Small population (21,997)
4) Very low population density – 0.05 people per acre and little/no urbanization
5) Small VMT (850,902) and very small commuter linkage to the Kansas City area
6) Minor growth in population by 2020 (9%)
7) Back trajectory analysis is somewhat supportive of contribution
8) Not located in the current 1-hour maintenance area or MSA and is located 80 km from the downtown area
9) Single largest NOx source is a utility being regulated under the statewide NOx rule

Miami County (KS)

1) Large point source NOx emissions (2,171 TPY), but small point source VOC emissions (164 TPY)
2) No ozone monitoring data collected
3) Small population (28,351)
4) Low population density (0.08 people per acre), and minimal urbanization
5) Small VMT (1,093,485), commuter linkage to the metropolitan area, but number of total employed residents is small (14,304)
6) 34% population growth by 2020
7) Back trajectory analysis is supportive of contribution
8) Located in MSA, not in current 1-hour maintenance area

Lafayette County

1) Small point source VOC emissions (151 TPY) and NOx emission (17 TPY)
2) No ozone monitoring data collected
3) Small population (32,960)
4) Low population density (0.08 people per acre) and minimal urbanization
5) Medium VMT (1,955,389) I-70 through-traffic, some commuter linkage (40% of employed residents work in the maintenance area, but total number of commuters is less than 7,000 people
6) Limited population growth (13%) by 2020
7) Meteorological analysis is not supportive of contribution
8) Located in MSA, not in current 1-hour maintenance area

Johnson (MO) County

1) Small point source emissions (88 TPY NOx and 91 TPY VOC)
2) No ozone monitoring data collected
3) Small/medium population (48,258)
4) 0.09 people per acre – population density and minimal urbanization
5) Small VMT (1,401,945) and very small commuter linkage to the Kansas City area
6) 22.8% population growth expected by 2020
7) Back trajectory is somewhat supportive of contribution
8) Not located in current 1-hour maintenance area or MSA

Atchison (KS) County

1) Medium NOx point source emissions (365 TPY), small point source VOC emissions (219 TPY VOC)
2) No ozone monitoring data collected
3) Small population (16,774)
4) Low population density (0.06 people per acre) and very limited urbanization
5) Very small VMT (343,635) and very small commuter linkage to the metropolitan area
6) Population reduction of 5.4% by 2020
7) Back trajectory analysis is not supportive of contribution
8) Not located in current 1-hour maintenance area or MSA

Franklin (KS) County

1) Small point source emissions (192 TPY NOx and 23 TPY VOC)
2) No ozone monitoring data collected
3) Small population (24,784)
4) Low population density (0.07 people per acre) and very limited urbanization
5) Small VMT (1,019,752) and very small number of commuters to the urban area
6) Population growth of 24% by 2020 (with small population)
7) Back trajectory analysis is not supportive of contribution
8) Not located in current 1-hour maintenance area or MSA

Clinton and Ray Counties

1) Very small point source emissions – Clinton 42 TPY VOC and 1 TPY NOx, Ray 25 TPY VOC and 14 TPY NOx
2) No ozone monitoring data collected
3) Small populations (Clinton 18,979 and Ray 23,354)
4) Low population densities (Clinton - 0.07 and Ray - 0.06 people per acre) and very limited urbanization
5) Small VMT (Clinton 917,787 and Ray 497,002) and very small number of commuters to the urban area, although about 50% of commuters from both counties work in the maintenance area
6) Population growth of 22% for Clinton and 14% for Ray by 2020
7) Back trajectory analysis is not supportive of contribution
8) Not located in current 1-hour maintenance area, but inside the MSA boundary

St. Louis MSA

CURRENT AIR QUALITY

The current and recent past air quality information for 8-hour ozone in the St. Louis MSA is presented in Tables 7 and 7B. Figure 11 denotes the current locations of the monitors within the St. Louis ozone network. Figure 12 provides information regarding sites that have been relocated in the recent past (old versus new location). As can be seen in Figure 12, the sites were moved to locations in the same area.

TABLE 7

Monitor	4th High 8-hour Ozone Values (ppb)							
	1995	1996	1997	1998	1999	2000	2001	2002
West Alton	112	98	90	97	99	88	85	99
Arnold	100	88	83	91	102	80	86	93
Orchard Farm	98	96	84	92	98	86	88	98
Jerseyville (IL)	88	83	82	91	100	83	84	100
S. Lindbergh	89	81	80	92	95	82	88	98
Ferguson	92	86	87	89	93	83	81	95
Bonne Terre		95	80	90	95	86	75	92
Edwardsville (IL)	96	88	82	88	92	78	75	90
St. Ann	93	80	82	92	88	81	-	-
Breckenridge							79	93
Alton (IL)	99	89	91	79	90	76	82	94
Maryville (IL)	87	90	88	84	85	78	73	90
Wood River (IL)	90	89	88	84	84	78	78	84
Queeny Park	88	82	75	89	93	88	84	94
Newstead	86	81	84	79	87	-	-	-
Margaretta						86	80	98
Clayton – Hunter	89	83	78	84	85	80	79	94
E. St. Louis (IL)	84	71	80	78	84	84	78	93
Nilwood – IL	85	88	76	79	85	83	73	85
S. Broadway	82	88	76	74	88	81	75	90
Clark & Tucker	67	73	77	76	81	67	71	81
Houston – IL	81	81	72	82	82	76	77	85

TABLE 7B

Monitor	95-97	96-98	97-99	98-00	99-01	00-02
	Average	Average	Average	Average	Average	Average
West Alton	**100**	**95**	**95**	**94**	**90**	**90**
Orchard Farm	**93**	**90**	**91**	**92**	**90**	**90**
Jerseyville (IL)	84	**85**	**91**	**91**	**89**	**89**
S. Lindbergh	83	84	**89**	**89**	**88**	**89**
Queeny Park	81	82	**85**	**90**	**88**	**88**
Newstead	83	81	83	-	-	-
Margaretta						**88**

Arnold	**90**	**87**	**92**	**91**	**89**	**86**
Ferguson	**88**	**87**	**89**	**88**	**85**	**86**
St. Ann	**85**	84	**87**	**87**	-	-
Breckenridge						**86***
E. St. Louis (IL)	78	76	80	82	82	**85**
Bonne Terre		**88**	**88**	**90**	**85**	84
Alton (IL)	**93**	**86**	**86**	81	82	84
Clayton – Hunter	83	81	82	83	81	84
S. Broadway	82	79	79	81	81	82
Edwardsville (IL)	**88**	**86**	**87**	**86**	81	81
Wood River (IL)	**89**	**87**	**85**	82	80	80
Nilwood – IL	83	81	80	82	80	80
Maryville (IL)	**88**	**87**	**85**	82	78	80
Houston – IL	78	78	78	80	78	79
Clark & Tucker	72	75	78	74	73	73

* Breckenridge design value based on 2001-02 data
BOLD denotes monitors that exceed the 85 ppb cutoff

The St. Louis area does not meet the 8-hour standard based on the 2000-02 ozone design values. The design value for St. Louis is 90 ppb (measured at the West Alton and Orchard Farm monitors). Nine monitors in the current 1-hour maintenance area have design values over the 8-hour ozone NAAQS. In addition, one monitor just outside the current maintenance area (Jerseyville - IL) has a design value that exceeds the 8-hour ozone NAAQS. The violating counties in the St. Louis MSA are St. Charles, St. Louis, St. Louis City, Jefferson, St. Clair, and Jersey. It is interesting to note the trend over the past few years in terms of 8-hour design value in the area. The design value was 100 ppb in 1995-97, 95 ppb in 1996-98 and 1997-99, 94 ppb in 1998-00, and 90 ppb for the last two monitoring periods.

ST. LOUIS AREA EMISSION, POPULATION, AND TRAFFIC INFORMATION

Table 8 denotes the 1999 NOx and VOC emissions by source sector for Missouri and Illinois (MSA) counties in the St. Louis area. This information is based on the recent submittal of the 1-hour maintenance plan inventory for the St. Louis area. Table 9 illustrates the total emission and population data for the counties in the St. Louis area. The vast majority of emissions in the MSA are located in the current 1-hour maintenance area (90% VOC and 95% NOx). Clinton (2.8% VOC and 2.6% NOx) county has the most emissions in the MSA outside the 1-hour maintenance area. Figures 13-17 show the density of emissions within the current modeling (4 km grid size) application for low-level point VOC, area VOC, mobile VOC, total low-level NOx, and elevated point NOx emissions, respectively. These emission plots illustrate the urban nature of these emissions and the highest density of emissions is seen in eastern St. Louis county near St. Louis City.

In the recent past, Missouri and Illinois have received several permit applications for large NOx sources in the areas to the south and southeast of St. Louis. One of these applications was approved in Missouri and will cause a net increase of over 4 TPD NOx

emissions. Ste. Genevieve county is the location of the recently permitted source and one of the other potential NOx permits. The information regarding the size of the proposed Missouri sources has been included in the emission summary tables for completeness.

The population data for 2000 in Table 9 shows six of the twelve MSA counties exceed 70,000 people. These counties include the seven 1-hour maintenance counties minus Monroe (IL). The population growth rates for many of the counties are of interest. St. Charles, Lincoln, Warren, Franklin, Jefferson, and Monroe have growth rates between 1990-2000 above 15%. There are no surrounding counties in Missouri with high population. Figure 18 provides 2000 population density information for many of the counties in the St. Louis area. This figure shows an urban population base that includes most of St. Louis City and County, northern Jefferson, and a portion of St. Charles county. Pockets of higher population density are located in Franklin and St. Francois counties. Figure 19 provides information regarding urban areas in the St. Louis region. This data supports the same conclusion as the population density figure. Much of the urbanization has occurred in the area contiguous to St. Louis City with St. Charles as a notable exception.

Figure 20 illustrates the traffic patterns in the St. Louis area based on data provided by MoDOT for 2001. These patterns suggest a typical pattern of high urban core traffic with the major interstate highways (70, 270, 44, and 55) contributing the majority of the remaining VMT. The interstate highways outside the "urban" area contribute the majority of the VMT in those particular counties. St. Francois county is a notable exception to this statement with no interstate highways and higher VMT than many of the other surrounding counties.

The St. Louis 1-hour maintenance area (St. Louis, St. Louis City, St. Charles, Jefferson, Franklin, Madison (IL), Monroe (IL), and St. Clair (IL)) have specific fuel requirements for control of VOC emissions. Since Missouri and Illinois opted into the federal reformulated gasoline program for the St. Louis area (Missouri 1999), reformulated gasoline (RFG) is required to be sold in these counties throughout the entire year, but lower volatility is required for RFG at terminals – May 1st and retail stations – June 1st through September 15th. In addition, the St. Louis maintenance area has a vehicle inspection and maintenance program (Missouri 10 CSR 10-5.380). There are several other VOC point and area source regulations in place in the Missouri portion of the maintenance area:

1) open burning 10 CSR 10-5.070,
2) petroleum storage/transfer (Stage I/II) 10 CSR 10-5.220,
3) aerospace manufacturing/rework 10 CSR 10-5.295,
4) solvent metal cleaning 10 CSR 10-5.300,
5) liquified cutback asphalt 10 CSR 10-5.310,
6) industrial surface coating 10 CSR 10-5.330,
7) rotogravure/flexographic printing 10 CSR 10-5.340,
8) synthesized pharmaceutical products 10 CSR 10-5.350,
9) polyethylene bag sealing operations 10 CSR 10-5.360,
10) application of deadeners and adhesives 10 CSR 10-5.370,
11) manufacturing of paint, laquer, varnish, enamels 10 CSR 10-5.390,

12) manufacturing of polystyrene resins 10 CSR 10-5.410,
13) equipment leaks from synthetic organic/polymer manufacturing 10 CSR 10-5.420,
14) bakery ovens 10 CSR 10-5.440,
15) offset lithographic printing 10 CSR 10-5.442,
16) traffic coatings 10 CSR 10-5.450,
17) aluminum foil rolling 10 CSR 10-5.451,
18) solvent cleanup operations 10 CSR 10-5.455,
19) municipal solid waste landfills 10 CSR 10-5.490,
20) volatile organic liquid storage 10 CSR 10-5.500,
21) existing major sources (RACT fixups) 10 CSR 10-5.520,
22) wood furniture manufacturing 10 CSR 10-5.530,
23) batch process operations 10 CSR 10-5.540,
24) reactor and distillation processes for synthetic organic chemical manufacture 10 CSR 10-5.550.

Also, Missouri has a NOx RACT rule (10 CSR 10-5.510) for major NOx sources in the St. Louis area. Missouri is committed to implement NO_x reduction requirements under the state rule 10 CSR 10-6.350 entitled "Emission Limitations and Emissions Trading of Oxides of Nitrogen." It establishes emission limitation on electric generating units (EGUs). EGUs in the eastern one-third of the state are subject to 0.25 lbs NO_x /MMBTU heat input emission limitation. The state of Illinois has been included in the NOx SIP call and EGU control will be set at 0.15 lb/MMBTU in the trading program.

METEOROLOGY OF OZONE FORMATION IN ST. LOUIS

APCP has conducted numerous modeling studies of ozone formation in St. Louis including the recent 1-hour attainment demonstration. The episodes for 1-hour ozone in St. Louis have had similar characteristics. Southwest, south, southeast, and east wind flows are the predominant directions for high 1-hour and 8-hour ozone. Northerly winds will produce exceedances at the Arnold and/or Bonne Terre monitoring locations, but are less frequent than the other flows listed above. It is interesting to note that frontal passages accompany many of these northerly wind episodes. The episodes in the current 1-hour attainment demonstration have southwesterly and southeasterly flow patterns. Based on the various analyses conducted, wind flows from the south are the most common for high 1-hour and 8-hour ozone in St. Louis. Stagnation events also contribute to several ozone 8-hour ozone episodes in the St. Louis area with a large number of exceedances in areas proximate to the downtown core.

Forward trajectories from the centroid of emissions in St. Louis have been included in Appendix A for all 8-hour exceedance days in 2000-02. Many of these trajectories illustrate a pattern of transport from the centroid (downtown) area to the monitors of interest. However, the Bonne Terre monitor is not directly influenced by the St. Louis plume on a number of exceedance days. The wind direction on these days appears to be coming from the south and southeast of the monitor based on the trajectory analysis. There are, at least, two possibilities for this phenomenon: (1) transport from the Memphis, southern Missouri, southern Illinois, and/or western Kentucky region and (2) north-south frontal passages that push the "upwind" St. Louis precursor emissions to the south and impact the Bonne Terre monitor. It is likely that both scenarios play a part in

ozone formation in this area. Conversely, the Bonne Terre site does have a direct influence from the St. Louis plume on the remaining exceedance days.

This type of trajectory analysis only gives an indication of the meteorological conditions on the days with high ozone concentrations at ozone monitors within the network. Also, the trajectory analysis can not be used to eliminate additional emission sources from culpability. During an exceedance at any monitor, additional non-core emissions would also contribute to ozone formation at that site.

One other analysis that was conducted was to evaluate the number of 8-hour exceedances within the last four years to ascertain where the high ozone concentrations are occurring within the St. Louis area. This information is included in Appendix A – Table 4. Since the monitoring network in and around St. Louis is more extensive than the Kansas City network, this type of analysis will lead to more definitive conclusions about the meteorological trends associated with ozone formation. The West Alton and Orchard Farm monitors have the largest number of 8-hour ozone exceedances during 1999-2002 with 51 and 36 respectively. These monitors are to the north and north-northwest of the metropolitan area indicating a typical southerly to south-southeasterly wind flow for the largest number of exceedances. In addition, the Alton monitor had 32 exceedances of the 8-hour standard. The Arnold, Sunset Hills, and Bonne Terre (distant southerly) sites monitored 34, 29, and 26 exceedances. Most of the sites in the St. Louis area have monitored greater than 10 exceedances during 1999-2002. The only other site of significant interest is the Jerseyville monitor with 25 exceedances at some distance from the metropolitan area.

OTHER INFORMATION REQUESTED IN THE EPA GUIDANCE

One jurisdictional boundary of interest is the current 8-county 1-hour maintenance area. One of the nearby, upwind MSAs of interest not discussed for Kansas City is Memphis, TN. The Memphis MSA design value is 93 ppb for 1999-01 and 90 ppb for 2000-02.

As seen in Table 9, population growth above 15% has occurred in the following counties between 1990-2000: Franklin, Jefferson, St. Charles, Lincoln, Warren, Crawford, and Monroe in Illinois. Additional population growth information for some of the counties is presented in Table 8. The 2000-2020 population growth data provides the same counties for growth above 15% as the 1990-00 information. However, Lincoln and Warren counties are still less than 60,000 people in 2020 with the population growth included. The highest growth rate is in St. Charles (33.3%) and St. Louis City has the largest population reduction (-12.2%).

Employment data are also included in Table 9. The employment data for the area illustrates the high employment of the 1-hour maintenance counties with respect to the MSA and other surrounding counties (98% of the MSA employment). St. Francois county is the only other county with employment larger than 1% of the MSA total (1.4%) Table 9A provides information regarding population projections for 1990-2020 for all counties. Projected population growth above 30% is expected to continue in St. Charles, Lincoln, Warren, and Monroe (IL) counties. Based on this information, the entire area is expected to grow with the exception of St. Louis City and County.

There are no significant geographic or topographic features in the St. Louis area.

The final piece of "connectivity" information is the workplace/resident relationship data from the 2000 census released in March 2003. Table 10 contains the raw data for the St. Louis area. This table is a matrix of residence versus employment location. For example, the number of people that live in St. Louis County and work in Jefferson County can be determined. Several important pieces of information can be gained from review of this data.

1) Over 90% of the employed people who live in the current 1-hour maintenance area work in the maintenance area (minimum Monroe 94.1%, maximum St. Louis City 98.9%).
2) The vast majority of employed people who live in the MSA work in the MSA (minimum Clinton 84.8%, maximum St. Louis City/County, St. Charles 98.9%).
3) Lincoln, Warren, Jersey (IL), and Clinton (IL) counties have the highest percentage of people who work in the NAA, but the total number of employed residents is less than 20,000 per county (minimum Clinton 34.6%, maximum Warren 52.0%).
4) There is no strong linkage to the NAA from any of the non-MSA counties in Missouri (maximum 31.6% Washington, 4,150 residents in St. Francois)

SUMMARY

The following table is a condensed summary of 8-hour ozone designation factors for counties generally within one county of the MSA. Tables 8 and 9 presented much of this same information for the initial screening of counties. This table can be used as a guide for selecting counties with greater opportunity to contribute to 8-hour ozone significantly in the St. Louis area. To reiterate, St. Charles County, St. Louis County, Jersey County (IL), St. Louis City, Jefferson County, and St. Clair County (IL) are the counties that have a monitor(s) that violates the 8-hour ozone standard for the 2000-02 design value period. The focus of Table 11 is to present as comprehensive evaluation as possible using objective metrics that (for all counties) can be used to address the emission and urbanization components of the boundary guidance.

Table 11: Summary of 8-Hour Designation Factors

County	1-Hr. NAA/ MSA	Total VOC % (TPD)	Total NOx % (TPD)	2000 Pop. % (1000)	2000 Pop. Density	Total Non-Met Summary
St. Louis	Yes/Yes	36.1 (138.9)	28.9 (184.5)	39.0(1016)	31.3	135.3
St. Louis City	Yes/Yes	11.9 (45.7)	9.0 (57.9)	13.4(348)	87.9	122.2
St. Charles	Yes/Yes	8.9 (34.3)	16.2 (103.7)	10.9 (284)	7.9	43.9
Madison (IL)	Yes/Yes	13.2 (50.9)	15.1 (96.6)	9.9 (259)	5.5	43.7
St. Clair (IL)	Yes/Yes	10.0 (38.6)	6.4 (41.1)	9.8 (256)	5.9	32.2
Jefferson	Yes/Yes	5.5 (21.1)	9.3 (59.5)	7.6 (198)	4.7	27.1
Franklin	Yes/Yes	4.5 (17.3)	8.7 (55.4)	3.6 (94)	1.6	18.4

Pike	No/No	3.3 (12.6)	5.3 (33.8)	0.7 (18)	0.4	9.7
Clinton (IL)	No/Yes	2.8 (11.0)	2.6 (16.7)	1.4 (36)	1.1	7.9
St. Francois	No/No	2.3 (9.0)	1.3 (8.0)	2.1 (56)	1.9	7.7
Lincoln	No/Yes	1.8 (7.0)	0.9 (5.8)	1.5 (39)	1.0	5.2
Monroe (IL)	Yes/Yes	1.8 (6.8)	1.1 (7.1)	1.1 (28)	1.0	5.0
Ste. Genevieve / Inc. Growth	No/No	1.2 (4.5) / 1.7 (6.5)	2.5 (15.7) / 6.4 (40.6)	0.7 (18)	0.6	4.9 / 9.3
Warren	No/Yes	1.9 (7.2)	0.9 (5.9)	0.9 (25)	0.9	4.6
Jersey (IL)	No/Yes	1.6 (6.0)	0.8 (5.0)	0.8 (22)	0.9	4.1
Crawford	No/No	1.8 (7.1)	0.8 (5.3)	0.9 (23)	0.5	4.0
Washington	No/No	1.2 (4.7)	0.4 (2.7)	0.9 (23)	0.5	3.0
Montgomery	No/No	1.2 (4.4)	0.9 (5.4)	0.5(12)	0.4	2.8
Gasconade	No/No	1.0 (3.9)	0.4 (2.8)	0.6 (15)	0.5	2.5

The population density metric is based on population/total county acreage * 10. This metric delivers a degree of urbanization to the summary. Based on this information, the following counties will receive no additional detailed analysis: Gasconade, Montgomery, Crawford, and Washington.

As with the Kansas City analysis, the meteorology of ozone formation in St. Louis City should be factored into this summary. As discussed above, the wind conditions associated with high ozone concentrations are easterly to southwesterly flows (with occasional northerly flow). This suggests less consideration should be given to Warren, Lincoln, Pike, and Jersey (IL) counties as frequent contributors to high ozone. In addition, Pike county is distant and isolated from the metropolitan area and is not part of the MSA.

Clinton (IL), St. Francois, and Ste. Genevieve are the counties not in the current 1-hour maintenance area to the east, south and southwest of the metropolitan area. These counties must be given close consideration due to the transport directions for St. Louis. Upwind impacts from emissions in Ste. Genevieve and St. Francois counties on St. Louis will occur but the magnitude of this contribution will be smaller than the counties in the current 1-hour maintenance area. These counties are rural in nature with smaller populations and less urbanization than the metropolitan St. Louis area. Nonetheless, Ste. Genevieve is the location of very large, permitted and potentially permitted NOx point source emission growth. As reflected in Table 11, the magnitude of the NOx emissions growth would illustrate emissions that would be of the same magnitude as two of the current 1-hour maintenance counties. If this type of potential growth in this geographic location occurs, there is a strong indication that future impacts from Ste. Genevieve county will be significant to 8-hour ozone formation in downwind St. Louis. St. Francois is the most urban of the surrounding counties (largest population, fairly high traffic counts, and most urban areas). However, the commuter linkage to the metropolitan area is not strong and 70% of the employed residents work in St. Francois county. In addition, the amount of point source emission does not suggest a large contribution from this source category.

Based on Table 11, there are several conclusions that can be drawn from the data. St. Louis City, St. Louis, Madison (IL), and St. Charles counties contribute the most to ozone in St. Louis. Then, there is a drop-off in potential contribution to St. Clair, Jefferson, and Franklin counties. Another drop-off occurs to Pike, Clinton (IL), St. Francois, Lincoln, Monroe (IL), Ste. Genevieve, Warren, and Jersey (IL). The counties in this last group are less likely to contribute frequently and significantly to ozone in St. Louis. However, the counties within this group should still be given consideration especially counties to the south and southeast of the metropolitan core. Jersey County is the only county outside the first two groups that has a violating monitor.

COUNTY BY COUNTY SUMMARY

The following is a county-by-county summary of factors that are specific to each county that were considered in the inclusion/exclusion evaluation for the St. Louis 8-hour ozone nonattainment area. These factors include precursor emissions, air quality data, population, population density/urbanization, traffic patterns/connectivity, meteorology, growth, and jurisdictional boundaries. In addition, if special consideration should be given to some additional factors (i.e. location of emission sources in the county or distance from the core metropolitan area) this is, also, presented. All factors in the EPA guidance were considered, but some were considered as a group (e.g. maintenance area VOC controls) earlier in the document. NOTE: the definitions for the descriptive terms used in this summary are contained in Table 13.

St. Louis County

1) Large emissions of NOx (184.5 TPD) and VOC (138.9 TPD)
2) Currently monitoring violation of the 8-hour NAAQS (four of the five monitors in the county violate the NAAQS with the S. Lindbergh site having the highest design value of 89 ppb)
3) Largest population in the area (1,016,315)
4) Second highest population density in the area (3.1 people per acre) and extremely urbanized
5) High VMT (33,048,068 in 1999) and part of the core metropolitan area
6) Meteorological analysis is supportive of contribution
7) Population reduction of 3% projected by 2020
8) Located in current 1-hour maintenance area and MSA

St. Louis City

1) Large emissions of NOx (57.9 TPD) and VOC (45.7 TPD)
2) Currently monitoring violation of the 8-hour ozone NAAQS at one of the three monitoring sites (Margaretta – design value of 88 ppb)
3) Large population (348,189)
4) Greatest population density in the area (8.8 people per acre) and completely urbanized
5) High VMT (8,642,387) and part of the core metropolitan area
6) Meteorological analysis is supportive of contribution
7) Population reduction of 40% projected by 2020

8) Located in current 1-hour maintenance area and MSA

Madison County (IL)

1) Large emissions of NOx (96.6 TPD) and VOC (50.9 TPD)
2) Not currently monitoring violation of the 8-hour NAAQS, but has monitored violations in the past (Alton site has the maximum design value of 84 ppb)
3) Large population (258,941)
4) Medium population density (0.55 people per acre) and significant urbanization in the western half of the county
5) Part of the core metropolitan area with 97% of employed residents working within the current 1-hour ozone maintenance area
6) Meteorological analysis is supportive of contribution
7) Population growth projected at 9% by 2020
8) Located in the current 1-hour maintenance area and MSA

St. Charles County

1) Large emissions of NOx (103.7 TPD) and VOC (34.3 TPD)
2) Currently monitoring violation of the 8-hour NAAQS with the highest design value in the area at both monitors (Orchard Farm and West Alton 90 ppb)
3) Large population (283,883)
4) Third highest population density (0.79 people per acre) and significant urbanization along the I-70 corridor through most of the county
5) High VMT (7,448,265) with significant connectivity to the other counties within the maintenance area (98% of employed residents work in the maintenance area)
6) Meteorological analysis is supportive of contribution to monitored violations
7) Highest population growth projected in the area (46% by 2020)
8) Located in the current 1-hour maintenance area and MSA

St. Clair County (IL)

1) Large emissions of NOx (41.1 TPD) and VOC (38.6 TPD)
2) Currently monitoring violation of the 8-hour NAAQS (E. St. Louis design value - 85 ppb)
3) Large population (256,082)
4) Population density of 0.6 people per acre with significant urbanization
5) Part of the core metropolitan area with 97% of employed residents working in the current 1-hour maintenance area
6) Meteorological analysis is supportive of contribution from emissions in this county
7) Reasonable population growth by 2020 (13%, large 2000 population)
8) Located in the current 1-hour maintenance area and MSA

Jefferson County

1) Large emissions of NOx (59.5 TPD) and VOC emissions (21.1 TPD)
2) Currently monitoring violation of the 8-hour NAAQS (Arnold – 86 ppb)
3) Large population (198,099)

4) Medium population density (0.5 people per acre), some urbanization in the eastern and northern portions of the county
5) High VMT (5,387,178) with 98% of the employed residents working in the 1-hour maintenance area
6) Meteorological analysis is supportive of contribution
7) Continued growth expected (26% population growth by 2020)
8) Located in the current 1-hour maintenance area and MSA

Franklin County

1) Large emissions of NOx (55.4 TPD) and VOC (17.3 TPD)
2) No ozone monitoring data collected
3) Large population (93,807)
4) Low population density of 0.2 people per acre, with urbanization along the I-44 corridor especially in eastern Franklin county, emission density is lower than other counties in the 1-hour maintenance area
5) High VMT (3,658,942) with 95% of employed residents working in the 1-hour maintenance area
6) Meteorological analysis is supportive of contribution
7) Continued growth expected (25% population growth by 2020)
8) Located in the current 1-hour maintenance area and MSA

Clinton County (IL)

1) Medium emissions of NOx (16.7 TPD) and VOC (11.0 TPD)
2) No ozone monitoring data collected
3) Small population (35,535)
4) Low population density of 0.11 people per acre, with limited urbanization
5) Not part of the core metropolitan area and only 35% of the 17,000 employed residents work in the 1-hour maintenance area, with a very low emission density
6) Meteorological analysis suggests Clinton is a possible "upwind" county (east of metropolitan area)
7) Minimal population growth estimated by 2020 (8%)
8) Located in the MSA, not in the current 1-hour maintenance area

Pike County

1) Large NOx emissions (33.8 TPD), medium VOC emissions (12.6)
2) No ozone monitoring data collected
3) Small population (18,351)
4) Low population density (0.04 people per acre) with very limited urbanization and very low emission density
5) Low VMT (737,066) and very small commuter linkage to the existing 1-hour maintenance area (7.7% of employed residents work in the maintenance area)
6) Meteorological analysis is not supportive of contribution (downwind under predominant wind direction)
7) Population reduction of less than 1% projected by 2020

8) Not located in the MSA or current 1-hour maintenance area and about 90 km from the downtown area

Jersey County (IL)

1) Small VOC emissions (5.0 TPD) and NOx emissions (6.0 TPD)
2) Monitoring violation of the 8-hour NAAQS (Jerseyville design value of 89 ppb)
3) Small population (21,668)
4) Low population density (0.09 people per acre) with limited urbanization and low emission density
5) Not part of the core metropolitan area, some commuter linkage (51% of employed residents work in the maintenance area, but only 10,223 employed residents)
6) Meteorological analysis illustrates Jersey county is downwind under predominant wind direction
7) Population growth is projected at 23% by 2020
8) Located in the MSA, not the current 1-hour maintenance area

St. Francois County

1) Medium emissions of NOx (8.0 TPD) and VOC (9.0 TPD)
2) No current ozone monitoring, but Bonne Terre site is very near the St. Francois/Ste. Genevieve county border
3) Medium population (55,641)
4) Low population density (0.19 people per acre) with noticeable urbanization around Farmington, the remainder of the county is rural with low emission density
5) Low/medium VMT (1,490,259) with limited connectivity to the metropolitan area (19% of employed residents commute to the current 1-hour maintenance area)
6) Meteorological analysis demonstrates that St. Francois is upwind under predominant winds
7) Population growth of 19% projected by 2020
8) Not located in the current 1-hour maintenance area or MSA, but contiguous with the 1-hour maintenance area

Monroe County (IL)

1) Medium VOC emissions (6.8 TPD), low NOx emissions (7.1 TPD)
2) No ozone monitoring data collected
3) Small population (27,619)
4) Low population density (0.11 people per acre), urbanization near the downtown area but fairly low emission density throughout the remainder of the county
5) Northern portion of the county is part of the metropolitan complex and 94% of employed residents work in the 1-hour maintenance area
6) Meteorological analysis demonstrates that Monroe county is upwind under predominant winds
7) Population growth is projected to be 32% by 2020
8) Located in current 1-hour maintenance area and MSA

Lincoln County

1) Medium VOC emissions (7.0 TPD), small NOx emissions (5.8 TPD)
2) No ozone monitoring data collected
3) Small population (38,944)
4) Low population density (0.09 people per acre), very limited urbanization and low emission density
5) Low VMT (1,169,073), fairly strong commuter linkage to the 1-hou r maintenance area (50%), but number of employed residents is small (18,386)
6) Meteorological analysis identifies Lincoln county as "downwind" under predominant wind direction
7) Population growth of 49% expected by 2020
8) Located in MSA, not in current 1-hour maintenance area

Warren County

1) Medium VOC emissions (7.2 TPD), small NOx emissions (5.9 TPD)
2) No ozone monitoring data collected
3) Small population (25,525)
4) Low population density (0.09 people per acre) with some urbanization along the I-70 corridor in the eastern half of the county
5) Low VMT (1,296,252), fairly strong commuter linkage to the 1-hour maintenance area (52%), but number of employed residents is small (11,978)
6) Meteorological analysis identifies Warren county as "downwind" under predominant wind direction
7) Population growth of 44% expected by 2020
8) Located in MSA, not in current 1-hour maintenance area

Ste. Genevieve County

1) Small VOC emissions (4.5 TPD), medium NOx emissions (15.7 TPD)
2) Monitored violation of the 8-hour NAAQS in the recent past at the Bonne Terre site (current design value of 84 ppb)
3) Small population (17,842)
4) Very low population density (0.05 people per acre), "rural" county
5) Low VMT (973,222), limited connectivity to the metropolitan area (21% of employed residents work in the 1-hour maintenance area)
6) Meteorological analysis demonstrates that Ste. Genevieve is upwind under predominant winds
7) Projected population growth of 13% by 2020, large (potential) VOC/NOx emissions including growth (**40.6** TPD NOx)
8) Not located in 1-hour maintenance area or MSA, but contiguous with the 1-hour maintenance area

Washington, Crawford, Montgomery, and Gasconade Counties

1) Small emissions (>5 TPD VOC, >4 TPD NOx)
2) No ozone monitoring data collected

3) Small population (>25,000)
4) Population density (>0.05 people per acre), all "rural" counties
5) Low VMTs (between 500,000 and 1,300,000), highest commuting percentage to the 1-hour maintenance area is Washington (31%), but all have less than 10,000 employed residents
6) Meteorological analysis offers some support for possible contribution from Crawford and Washington counties
7) Population growth rates range from 10% (Montgomery) to 29% (Crawford)
8) Not located in current 1-hour maintenance area or MSA

Remainder of Missouri

The current and recent past air quality information for the two ozone monitors in the Springfield MSA and the monitor in Mark Twain State Park (Monroe County) is contained in Table 12A and 12B.

TABLE 12A

Monitor	4th High 8-hour Ozone Values (ppb)							
	1995	1996	1997	1998	1999	2000	2001	2002
S. Charleston	73	67	64	71	75	78	72	78
Hillcrest	85	81	68	71	81	74	71	74
Mark Twain	83	89	80	79	92	76	76	85

TABLE 12B

Monitor	95-97	96-98	97-99	98-00	99-01	00-02
	Average	Average	Average	Average	Average	Average
S. Charleston	68	67	70	74	75	76
Hillcrest	78	73	73	75	75	73
Mark Twain	84	82	83	82	81	79

The Springfield MSA monitors are well below the 8-hour NAAQS. The Mark Twain State Park monitor is below the NAAQS. In the past, this monitor has been influenced by the St. Louis ozone plume to a large extent. This behavior is likely to continue and the Mark Twain site will monitor lower 8-hour ozone concentrations as additional controls are put in place in St. Louis and utility controls are implemented throughout Missouri.

Table 13: Definition of Terms Used in the County-by-County Summary for Each Area

Factors	Definition of Terms
Kansas City (only)	
Point Source Emissions	
Small	<365 TPY (1 TPD)
Medium	>365 TPY, <730 TPY (2 TPD)
Large	>730 TPY
St. Louis (only)	
Total Emissions	
Small	VOC <7.7 TPD, NOx <12.8 TPD (2% of MSA total)
Medium	VOC >7.7, <15.4 TPD; NOx >12.8 TPD, <25.6 TPD (2-4% of MSA total)
Large	VOC >15.4 TPD; NOx >25.6 TPD (>4% of MSA total)
Both Areas	
Population	
Small	<45,000 people
Medium	>45,000 people, <90,000 people
Large	>90,000 people
Population Density	
Low	<0.5 people per acre
Medium	>0.5, <1.0 people per acre
High	>1.0 people per acre
VMT/Commuter Patterns	
Small	<1,500,000 VMT/day; <30% commuter connection to the maintenance area
Medium	>1,500,000 , <3,000,000 VMT/day; >30%, <60% commuter connection
Large	>3,000,000 VMT/day, >60% commuter connection to the maintenance area
Population Growth	
Low	<15% population growth projected from 2000 to 2020
Medium	>15%, <30% population growth projected from 2000 to 2020
High	>30% population growth projected from 2000 to 2020

TABLE 2: Emissions, Population, VMT, and Employment Data for the Kansas City Area

MISSOURI	2000 VOC Pt.Emission (TPY)	2000 NOx Pt.Emission (TPY)	1990 Population	2000 Population	1999 VMT/day	2000 Employment	% VOC Point MSA	% NOx Point MSA	% 2000 Population MSA	Pop. Growth 1990-2000 (%)	Employ (%) MSA
JACKSON	1,910	18,423	633,234	654,880	18,539,255	376,186	23.4%	49.9%	36.9%	3.4%	42.2%
CLAY	2,397	815	180,111	184,006	6,317,145	84,593	29.4%	2.2%	10.4%	2.2%	9.5%
PLATTE	401	6,183	57,867	73,781	3,159,378	35,766	4.9%	16.8%	4.2%	27.5%	4.0%
CASS	86	84	63,808	82,092	2,680,904	15,483	1.1%	0.2%	4.6%	28.7%	1.7%
LAFAYETTE	190	62	31,107	32,960	1,955,389	7,087	2.3%	0.2%	1.9%	6.0%	0.8%
CLINTON	42	1	16,595	18,979	917,787	3,433	0.5%	0.0%	1.1%	14.4%	0.4%
RAY	25	14	21,968	23,354	497,002	3,721	0.3%	0.0%	1.3%	6.3%	0.4%
MISSOURI MSA	**5,051**	**25,582**	**1,004,690**	**1,070,052**	**34,066,859**	**526,269**	**61.9%**	**69.4%**	**60.2%**	**6.5%**	**59.0%**
Buchanan	988	3,758	83,083	85,998	1,915,642	37,081	12.1%	10.2%	4.8%	3.5%	4.2%
Henry	231	5,648	20,044	21,997	850,902	7,367	2.8%	15.3%	1.2%	9.7%	0.8%
Johnson	91	88	42,514	48,258	1,401,945	9,950	1.1%	0.2%	2.7%	13.5%	1.1%
Pettis	469	1,868	35,437	39,403	1,267,507	17,666	5.7%	5.1%	2.2%	11.2%	2.0%
Saline	18	409	23,523	23,756	1,324,892	7,648	0.2%	1.1%	1.3%	1.0%	0.9%
Bates	3	31	15,025	16,653	737,459	3,053	0.0%	0.1%	0.9%	10.8%	0.3%
Carroll	91	237	10,748	10,285	334,568	2,003	1.1%	0.6%	0.6%	-4.3%	0.2%
DeKalb	7	71	9,967	11,597	472,676	1,492	0.1%	0.2%	0.7%	16.4%	0.2%
Caldwell	4	0	8,380	8,969	406,882	1,004	0.0%	0.0%	0.5%	7.0%	0.1%

KANSAS	2000 VOC Pt.Emission (TPY)	2000 NOx Pt.Emission (TPY)	1990 Population	2000 Population	2000 VMT/day	2000 Employment	% VOC Point MSA	% NOx Point MSA	% 2000 Population MSA	Pop. Growth 1990-2000 (%)	Employ (%) MSA
JOHNSON	746	1,487	355,021	451,086	13,289,730	282,652	9.1%	4.0%	25.4%	27.1%	31.7%
WYANDOTTE	2,153	7,483	162,026	157,882	4,668,108	61,588	26.4%	20.3%	8.9%	-2.6%	6.9%
MIAMI	141	2,267	23,466	28,351	1,093,485	6,868	1.7%	6.1%	1.6%	20.8%	0.8%
LEAVENWORTH	69	69	64,371	68,691	1,424,245	15,044	0.8%	0.2%	3.9%	6.7%	1.7%
KANSAS MSA	**3,109**	**11,306**	**604,884**	**706,010**	**20,475,568**	**366,152**	**38.1%**	**30.6%**	**39.8%**	**16.7%**	**41.0%**
Linn	300	33,330	8,254	9,570	342,917	1,381	3.7%	90.4%	0.5%	15.9%	0.2%
Douglas	140	7,443	81,798	99,962	2,411,839	37,485	1.7%	20.2%	5.6%	22.2%	4.2%
Atchison	219	365	16,932	16,774	343,635	5,972	2.7%	1.0%	0.9%	-0.9%	0.7%
Franklin	23	192	21,994	24,784	1,019,752	7,712	0.3%	0.5%	1.4%	12.7%	0.9%
Jefferson	0	0	15,905	18,426	574,751	2,205	0.0%	0.0%	1.0%	15.9%	0.2%
Anderson	185	175	7,803	8,110	270,575	1,608	2.3%	0.5%	0.5%	3.9%	0.2%
MAINTENANCE AREA	**7,607**	**34,391**	**1,388,259**	**1,521,635**	**45,973,616**	**840,785**	**93.2%**	**93.2%**	**85.7%**	**9.6%**	**94.2%**
MSA	**8,160**	**36,888**	**1,609,574**	**1,776,062**	**54,542,427**	**892,421**	**100.0%**	**100.0%**	**100.0%**	**10.3%**	**100.0%**

Maintenance Area VMT 1999 from MARC, Other Kansas VMT 2000 from KDOT, Other Missouri VMT 1999 from MoDOT

Employment Data from County Business Patterns

Population Data from U.S. Census Bureau

Table 3: Point, Area, and Mobile VOC/NOx Emissions fro the Missouri Counties in the Kansas City Area

MISSOURI	2000 VOC Point (TPD)	2000 NOx Point (TPD)	1999 VOC Area (TPD)	1999 NOx Area (TPD)	1999 VOC Mobile (TPD)	1999 NOx Mobile (TPD)	Total VOC (TPD)	Total NOx (TPD)
JACKSON	5.23	50.47	30.29	9.59	37.23	61.65	72.76	121.72
CLAY	6.57	2.23	9.26	2.87	12.69	21.01	28.51	26.11
PLATTE	1.10	16.94	3.59	0.53	6.35	10.51	11.03	27.97
CASS	0.24	0.23	4.88	0.47	5.71	8.59	10.83	9.29
LAFAYETTE	0.52	0.17	2.69	0.33	4.16	6.26	7.37	6.76
CLINTON	0.12	0.00	1.58	0.14	1.95	2.94	3.65	3.08
RAY	0.07	0.04	1.82	0.25	1.06	1.59	2.95	1.88
MAINTENANCE AREA	20.84	94.22	89.93	23.32	92.33	152.89	203.10	270.43
MISSOURI MSA	***13.84***	***70.09***	***54.12***	***14.17***	***69.15***	***112.55***	***227.90***	***291.43***
Buchanan	2.71	10.30	5.78	1.42	4.08	6.13	12.56	17.85
Johnson	0.25	0.24	3.34	0.48	2.98	4.49	6.57	5.21
Pettis	1.28	5.12	4.05	1.01	2.70	4.06	8.03	10.19
Saline	0.05	1.12	2.92	0.50	2.82	4.24	5.79	5.86
Henry	0.63	15.47	2.09	0.33	1.81	2.72	4.53	18.53
Bates	0.01	0.08	1.76	0.15	1.57	2.36	3.34	2.59
DeKalb	0.02	0.19	1.45	0.21	1.01	1.51	2.48	1.92
Carroll	0.25	0.65	1.73	0.23	0.71	1.07	2.69	1.95
Caldwell	0.01	0.00	0.89	0.10	0.87	1.30	1.77	1.40
JOHNSON (KS)	2.04	4.07	35.16	8.02	26.69	44.20	63.90	56.29
WYANDOTTE (KS)	5.90	20.50	11.62	2.31	9.38	15.52	26.90	38.33

Daily point source emissions were estimated as tons per year / 365
Emission totals do not include non-road mobile emissions

Table 4: County Population Projections for the Kansas City Area

MISSOURI	1990	1995	2000	2000 Actual	2005	2010	2015	2020	% Growth 2000-2020
JACKSON	633,232	643,565	651,084	654,880	656,227	660,763	665,654	670,248	2.9%
CLAY	153,411	166,396	179,441	184,006	190,812	201,073	210,718	219,626	22.4%
PLATTE	57,867	65,902	73,227	73,781	80,033	86,386	92,379	98,014	33.8%
CASS	63,808	73,371	82,773	82,092	91,588	99,954	107,826	114,925	38.8%
LAFAYETTE	31,107	32,061	33,043	32,960	34,042	35,114	36,228	37,291	12.9%
CLINTON	16,595	17,803	19,107	18,979	20,315	21,470	22,512	23,376	22.3%
RAY	21,971	22,346	23,190	23,354	24,012	24,868	25,725	26,499	14.3%
MISSOURI MSA	***977,991***	***1,021,444***	***1,061,865***	***1,070,052***	***1,097,029***	***1,129,628***	***1,161,042***	***1,189,979***	***12.1%***
Buchanan	83,083	82,491	83,014	85,998	82,108	81,406	80,988	80,722	-2.8%
Henry	20,044	20,878	21,586	21,997	22,221	22,777	23,231	23,484	8.8%
Johnson	42,514	45,817	49,016	48,258	51,960	54,796	57,580	60,210	22.8%
Pettis	35,437	36,740	37,642	39,403	38,537	39,454	40,407	41,331	9.8%
Saline	23,523	22,997	22,564	23,756	22,219	21,958	21,758	21,584	-4.3%
Bates	15,025	15,489	15,983	16,653	16,466	16,964	17,417	17,783	11.3%
Carroll	10,748	10,361	9,990	10,285	9,659	9,346	9,054	8,779	-12.1%
DeKalb	9,967	11,532	13,351	11,597	13,678	14,008	14,324	14,597	9.3%
Caldwell	8,380	8,535	8,732	8,969	8,945	9,176	9,424	9,640	10.4%

KANSAS	1990	2000	2000 Actual	2010	2020	% Growth 2000-2020
JOHNSON	355,021	433,852	451,086	509,641	585,429	34.9%
WYANDOTTE	162,026	152,667	157,882	146,087	139,507	-8.6%
MIAMI	23,466	28,190	28,351	32,928	37,665	33.6%
LEAVENWORTH	64,393	73,749	68,691	83,061	92,373	25.3%
KANSAS MSA	***604,906***	***688,458***	***706,010***	***771,717***	***854,974***	***24.2%***
Linn	8,254	9,039	9,570	9,832	10,624	17.5%
Douglas	81,798	101,459	99,962	121,377	141,294	39.3%
Atchison	16,932	16,428	16,774	15,986	15,543	-5.4%
Franklin	21,994	24,933	24,784	27,968	31,003	24.3%
Jefferson	15,960	18,058	18,426	20,213	22,368	23.9%
Anderson	7,803	8,144	8,110	8,497	8,850	8.7%

Missouri information developed by the Office of Admininstration / Division of Budget and Planning May 1999
Kansas information developed by the Kansas Water Office and approved by the Division of Budget June 1999

Table 5: Place of Residence/Employent Matrix (County by County)

MISSOURI

	Employment (MO)																Missouri
Residence	Bates	Buchanan	Carroll	Caldwell	Cass	Clay	Clinton	DeKalb	Henry	Jackson	Johnson	Lafayette	Pettis	Platte	Ray	Saline	Total
JACKSON	47	128	0	0	2,777	14,451	36	14	77	233,408	657	538	50	4,078	123	43	256,427
CLAY	0	253	3	6	113	47,238	194	16	33	26,812	96	11	12	10,039	372	6	85,204
PLATTE	0	519	0	0	26	7,119	64	6	10	9,548	44	17	0	16,264	9	4	33,630
CASS	88	0	0	5	14,616	816	0	0	71	16,208	233	42	13	216	5	0	32,313
LAFAYETTE	0	9	74	0	93	502	2	0	10	5,184	380	7,926	43	72	258	316	14,869
RAY	0	12	58	77	4	3,806	32	2	17	1,794	13	297	0	246	3,883	2	10,243
CLINTON	0	769	0	52	5	2,257	3,015	624	0	1,004	8	6	4	441	47	0	8,232
MISSOURI MSA	135	1,690	135	140	17,634	76,189	3,343	662	218	293,958	1,431	8,837	122	31,356	4,697	371	440,918
Buchanan	0	32,889	0	50	12	501	214	161	0	752	7	7	0	1,141	0	17	35,751
Johnson	11	4	0	10	333	290	6	0	431	3,595	16,484	502	870	77	28	29	22,670
Pettis	5	0	0	0	4	47	0	0	121	242	897	33	15,759	0	4	339	17,451
Saline	0	0	49	0	5	42	0	0	0	146	42	376	380	9	22	9,549	10,620
Henry	46	0	0	0	346	73	0	0	7,117	656	580	20	319	8	2	9	9,176
Bates	4,098	0	0	0	834	68	0	0	73	937	10	7	7	19	0	5	6,058
DeKalb	0	1,079	0	7	14	223	418	1,738	6	124	0	0	0	71	15	0	3,695
Carroll	0	4	3,057	38	0	132	4	11	0	170	3	99	7	9	280	191	4,005
Caldwell	0	74	16	1,508	6	595	390	355	0	385	3	13	0	82	90	0	3,517
Missouri Total	4,295	35,740	3,257	1,753	19,188	78,160	4,375	2,927	7,966	300,965	19,457	9,894	17,464	32,772	5,138	10,510	553,861

KANSAS

Residence	Bates	Buchanan	Carroll	Caldwell	Cass	Clay	Clinton	DeKalb	Henry	Jackson	Johnson	Lafayette	Pettis	Platte	Ray	Saline	Total
JOHNSON	38	106	0	0	587	3,766	0	0	7	49,687	56	33	0	1,984	13	13	56,290
WYANDOTTE	0	18	0	0	75	1,707	0	0	0	11,004	17	3	0	1,163	0	0	13,987
LEAVENWORTH	0	26	3	0	72	351	0	0	17	1,701	24	7	0	712	0	0	2,913
MIAMI	5	21	6	0	94	70	0	0	6	934	0	7	0	31	0	0	1,174
KANSAS MSA	43	171	9	0	828	5,894	0	0	30	63,326	97	50	0	3,890	13	13	74,364
Douglas	0	10	0	0	8	149	0	0	11	1,450	17	0	0	60	0	0	1,705
Franklin	0	4	0	0	14	52	0	0	21	270	0	2	0	25	0	0	388
Jefferson	0	7	0	0	0	23	0	0	0	157	0	8	0	13	0	0	208
Atchison	0	254	0	0	0	40	0	0	0	90	0	0	0	220	0	0	604
Linn	66	0	0	0	37	19	0	0	0	193	0	9	0	13	0	0	337
Anderson	0	0	0	4	8	11	0	0	0	44	0	0	0	2	0	0	69
Shawnee	0	7	0	0	13	123	0	0	10	448	10	21	0	38	5	0	675
Kansas Total	109	453	9	4	908	6,311	0	0	72	65,978	124	90	0	4,261	18	13	78,350
TOTAL IC	4,404	36,193	3,266	1,757	20,096	84,471	4,375	2,927	8,038	366,943	19,581	9,984	17,464	37,033	5,156	10,523	632,211
TOTAL Workforce	4,897	43,784	3,382	1,966	20,436	86,055	4,886	3,544	9,227	372,461	20,045	10,115	19,872	37,758	5,296	11,026	

Table 5: Place of Residence/Employent Matrix (County by County)

MISSOURI	Employment (KS)												Total Resident	% Work in	% Work in	% Work in	% Work in
Residence	Anderson	Atchison	Douglas	Franklin	Jefferson	Johnson	Leavenworth	Linn	Miami	Shawnee	Wyandotte	Total IC	Who Work	Main. Area	MSA	MA+County	County
JACKSON	0	6	308	59	11	39,018	259	8	80	332	11,585	308,093	310,789	97.3%	98.6%	97.3%	75.1%
CLAY	0	25	75	13	0	5,938	229	0	8	112	4,267	95,871	96,971	97.2%	98.2%	97.2%	48.7%
PLATTE	0	96	32	9	0	3,304	793	0	10	71	2,452	40,397	40,998	94.4%	96.6%	94.4%	39.7%
CASS	0	0	38	48	0	6,686	10	35	224	57	977	40,388	40,755	61.1%	97.7%	97.0%	35.9%
LAFAYETTE	0	0	2	2	0	341	5	2	7	11	281	15,520	15,798	40.4%	92.9%	90.6%	50.2%
RAY	0	0	0	0	0	161	2	0	0	17	300	10,723	10,829	58.2%	97.2%	94.1%	35.9%
CLINTON	0	3	16	8	0	146	17	0	0	0	291	8,713	8,981	46.1%	80.5%	79.7%	33.6%
MISSOURI MSA	0	130	471	139	11	55,594	1,315	45	329	600	20,153	519,705	525,121				
Buchanan	0	461	14	2	0	318	114	9	9	0	283	36,961	38,702	7.7%	8.7%	92.7%	85.0%
Johnson	0	0	16	4	0	484	20	0	1	6	245	23,446	23,890	19.6%	23.4%	88.6%	69.0%
Pettis	0	0	6	24	0	73	0	0	0	0	15	17,569	18,286	2.1%	2.3%	88.2%	86.2%
Saline	0	0	0	0	0	21	0	0	0	0	43	10,684	11,203	2.3%	5.9%	87.6%	85.2%
Henry	0	0	0	28	0	148	18	2	0	0	43	9,415	9,838	9.4%	13.4%	81.8%	72.3%
Bates	0	0	13	7	0	428	0	168	72	4	77	6,827	7,292	21.0%	33.5%	77.2%	56.2%
DeKalb	0	4	0	0	0	28	2	0	0	5	24	3,758	3,980	11.8%	23.1%	55.5%	43.7%
Carroll	2	0	0	0	0	28	2	0	0	0	2	4,039	4,578	7.4%	15.9%	74.2%	66.8%
Caldwell	0	3	0	0	0	47	5	0	0	0	99	3,671	4,007	30.1%	42.7%	67.8%	37.6%
Missouri Total	2	598	520	204	11	57,169	1,476	224	411	615	20,984	636,075	646,897				

KANSAS																	
Residence	Anderson	Atchison	Douglas	Franklin	Jefferson	Johnson	Leavenworth	Linn	Miami	Shawnee	Wyandotte	Total IC					
JOHNSON	33	60	1,462	314	25	165,924	847	12	564	568	14,791	240,890	243,908	96.8%	97.7%	96.8%	68.0%
WYANDOTTE	0	0	200	67	0	18,996	612	18	63	200	31,919	66,062	66,696	97.1%	98.3%	97.1%	47.9%
LEAVENWORTH	0	413	785	6	95	3,560	19,105	0	25	178	3,793	30,873	31,223	32.4%	93.9%	93.6%	61.2%
MIAMI	26	0	120	357	0	5,950	14	103	5,930	29	427	14,130	14,304	51.8%	94.1%	93.3%	41.5%
KANSAS MSA	59	473	2,567	744	120	194,430	20,578	133	6,582	975	50,930	351,955	356,131				
Douglas	5	63	41,414	403	216	5,578	509	27	58	3,061	796	53,835	54,496	14.7%	15.8%	90.7%	76.0%
Franklin	87	2	961	7,290	0	2,474	21	14	249	202	240	11,928	12,161	25.2%	27.5%	85.1%	59.9%
Jefferson	0	160	1,640	15	2,894	279	400	0	12	2,811	183	8,602	8,876	7.4%	12.1%	40.0%	32.6%
Atchison	0	5,927	43	0	90	115	302	0	0	114	70	7,265	7,665	7.0%	10.9%	84.3%	77.3%
Linn	37	0	9	40	0	888	12	2,094	497	2	122	4,038	4,317	28.6%	41.5%	77.1%	48.5%
Anderson	2,285	0	70	287	0	234	0	30	220	19	41	3,255	3,743	8.9%	15.0%	69.9%	61.0%
Shawnee	0	28	1,317	83	406	608	108	0	69	78,127	335	81,756	83,741	1.9%	2.1%	95.1%	93.3%
Kansas Total	2,473	6,653	48,021	8,862	3,726	204,606	21,930	2,298	7,687	85,311	52,717	522,634	531,130				
TOTAL IC	2,475	7,251	48,541	9,066	3,737	261,775	23,406	2,522	8,098	85,926	73,701	1,158,709	1,178,027				
TOTAL Workforce	2,648	7,874	49,301	9,871	3,876	265,363	23,977	2,728	8,224	95,850	76,028						

Table 8: 1999 Emission Inventory for Missouri and Illinois (MSA) Counties in the St. Louis Area

	VOC (TPD)				NOx (TPD)			
MISSOURI	POINT	AREA/NR	MOBILE	TOTAL	POINT	AREA/NR	MOBILE	TOTAL
ST. LOUIS	17.99	55.82	65.10	138.91	24.04	51.70	108.79	184.53
ST. LOUIS CITY	12.61	16.01	17.03	45.65	7.64	21.76	28.45	57.85
ST. CHARLES	6.62	13.02	14.67	34.31	62.96	16.23	24.52	103.71
JEFFERSON	3.18	7.34	10.61	21.13	35.05	6.73	17.73	59.51
FRANKLIN	3.62	5.42	8.29	17.33	33.64	9.39	12.40	55.43
LINCOLN	0.35	4.18	2.49	7.03	0.37	1.45	4.00	5.82
WARREN	0.47	4.01	2.76	7.24	0.39	1.13	4.43	5.95
Missouri MSA	44.84	105.80	120.95	271.60	164.10	108.39	200.31	472.80
St. Francois	0.29	5.47	3.23	8.99	1.30	1.52	5.18	8.00
Washington	0.16	2.35	2.15	4.67	0.14	0.37	2.15	2.66
Crawford	0.69	3.61	2.76	7.06	0.06	0.85	4.43	5.33
Pike	8.29	2.72	1.55	12.56	29.71	1.57	2.49	33.77
Ste. Genevieve	0.47	1.93	2.11	4.52	11.50	0.84	3.38	15.72
Ste. Genevieve (Growth)	2.52	1.91	2.11	6.55	36.37	0.86	3.38	40.61
Gasconade	0.36	2.39	1.13	3.88	0.16	0.84	1.81	2.80
Montgomery	0.01	1.94	2.49	4.44	0.31	1.13	4.00	5.43
ILLINOIS								
CLINTON	0.38	7.62	2.95	10.95	8.35	4.59	3.79	16.73
JERSEY	0.38	2.68	2.95	6.02	0.00	2.79	2.17	4.96
MADISON	12.94	24.22	13.69	50.85	57.30	11.80	27.50	96.60
MONROE	0.17	4.92	1.76	6.84	0.65	3.22	3.27	7.14
ST. CLAIR	4.39	21.21	12.97	38.57	4.66	10.36	26.03	41.05
Illinois MSA	18.26	60.65	34.32	113.24	70.96	32.76	62.75	166.47
MSA Total	63.10	166.45	155.27	384.83	235.06	141.15	263.06	639.27

COUNTY - Counties in the 1-Hour Nonattainment Area
COUNTY - Counties in the MSA
County - Additional Counties

Table 9: Emissions, Population, and Employment Data for St.Louis Area

	VOC	NOx	%VOC	%NOx	2000	1990	2000	%2000	Pop Growth
MISSOURI	(TPD)	(TPD)	MSA	MSA	Emplymnt	Pop.	Pop.	Pop (MSA)	1990-00
ST. LOUIS	138.91	184.53	36.1%	28.9%	586,848	993,529	1,016,315	39.0%	2.3%
ST. LOUIS CITY	45.65	57.85	11.9%	9.0%	263,578	396,685	348,189	13.4%	-12.2%
ST. CHARLES	34.31	103.71	8.9%	16.2%	95,534	212,907	283,883	10.9%	33.3%
JEFFERSON	21.13	59.51	5.5%	9.3%	35,679	171,380	198,099	7.6%	15.6%
FRANKLIN	17.33	55.43	4.5%	8.7%	31,821	80,603	93,807	3.6%	16.4%
LINCOLN	7.03	5.82	1.8%	0.9%	6,922	28,892	38,944	1.5%	34.8%
WARREN	7.24	5.95	1.9%	0.9%	5,967	19,534	24,525	0.9%	25.6%
Missouri MSA	**271.60**	**472.80**	**70.6%**	**74.0%**	**1,026,349**	**1,903,530**	**2,003,762**	**77.0%**	**5.3%**
St. Francois	8.99	8.00	2.3%	1.3%	16,577	48,904	55,641	2.1%	13.8%
Washington	4.67	2.66	1.2%	0.4%	2,926	20,380	23,344	0.9%	14.5%
Crawford	7.06	5.33	1.8%	0.8%	5,152	19,173	22,804	0.9%	18.9%
Pike	12.56	33.77	3.3%	5.3%	3,810	15,969	18,351	0.7%	14.9%
Ste. Genevieve	4.52	15.72	1.2%	2.5%	5,284	16,037	17,842	0.7%	11.3%
Ste. Genevieve (Growth)	6.55	40.61	1.7%	6.4%	5,284	16,037	17,842	0.7%	11.3%
Gasconade	3.88	2.80	1.0%	0.4%	4,698	14,006	15,342	0.6%	9.5%
Montgomery	4.44	5.43	1.2%	0.9%	2,850	11,355	12,136	0.5%	6.9%
ILLINOIS									
CLINTON	10.95	16.73	2.8%	2.6%	8,111	33,944	35,535	1.4%	4.7%
JERSEY	6.02	4.96	1.6%	0.8%	4,638	20,539	21,668	0.8%	5.5%
MADISON	50.85	96.60	13.2%	15.1%	85,279	249,238	258,941	9.9%	3.9%
MONROE	6.84	7.14	1.8%	1.1%	6,240	22,422	27,619	1.1%	23.2%
ST. CLAIR	38.57	41.05	10.0%	6.4%	75,291	262,852	256,082	9.8%	-2.6%
Illinois MSA	**113.24**	**166.47**	**29.4%**	**26.0%**	**179,559**	**588,995**	**599,845**	**23.0%**	**1.8%**
MSA Total	**384.83**	**639.27**			**1,205,908**	**2,492,525**	**2,603,607**		

COUNTY - Counties in the 1-Hour Nonattainment Area
COUNTY - Counties in the MSA
County - Additional Counties

Table 9A: County Population Projections for the St.Louis Area

MISSOURI	**1990**	**1995**	**2000**	**2000 Actual**	**2005**	**2010**	**2015**	**2020**	**% Growth 2000-2020**
ST. LOUIIS	993,529	1,003,356	1,003,268	1,016,315	996,268	986,265	977,159	969,774	-3.3%
ST. LOUIS CITY	396,685	360,720	322,734	348,189	286,109	251,773	220,366	191,908	-40.5%
ST. CHARLES	212,907	246,339	281,816	283,883	315,618	348,587	381,032	411,984	46.2%
JEFFERSON	171,380	185,475	200,159	198,099	214,120	227,729	240,738	252,463	26.1%
FRANKLIN	80,603	87,296	94,339	93,807	100,937	107,200	113,067	118,279	25.4%
LINCOLN	28,892	32,743	37,183	38,944	41,650	46,235	50,838	55,260	48.6%
WARREN	19,534	22,354	25,219	24,525	28,043	30,864	33,656	36,273	43.8%
MISSOURI MSA	***1,903,530***	***1,938,283***	***1,964,718***	***2,003,762***	***1,982,745***	***1,998,653***	***2,016,856***	***2,035,941***	***3.6%***
St. Francois	48,904	53,092	56,673	55,641	59,831	62,753	65,324	67,530	19.2%
Washington	20,380	21,910	23,272	23,344	24,486	25,611	26,601	27,448	17.9%
Crawford	19,173	21,241	23,186	22,804	25,081	26,864	28,479	29,943	29.1%
Pike	15,969	16,145	16,760	18,351	16,809	16,829	16,783	16,677	-0.5%
Ste. Genevieve	16,037	16,597	17,317	17,842	17,977	18,591	19,153	19,610	13.2%
Gasconade	14,006	14,415	15,022	15,342	15,634	16,264	16,911	17,491	16.4%
Montgomery	11,355	11,606	11,933	12,136	12,269	12,592	12,876	13,095	9.7%
ILLINOIS	**1990**	**1995**	**2000**	**2000 Actual**	**2005**	**2010**	**2015**	**2020**	**% Growth 2000-2020**
CLINTON	33,944	35,309	36,086	35,535	36,574	37,147	38,010	39,032	8.2%
JERSEY	20,539	22,032	22,930	21,668	23,845	24,772	26,070	28,082	22.5%
MADISON	249,238	256,246	260,445	258,941	265,765	270,355	275,224	284,362	9.2%
MONROE	22,422	24,789	26,938	27,619	29,105	31,140	33,106	35,545	32.0%
ST. CLAIR	262,852	266,038	280,070	256,082	289,841	299,642	307,460	315,727	12.7%
ILLINOIS MSA	***588,995***	***604,414***	***626,469***	***599,845***	***645,130***	***663,056***	***679,870***	***702,748***	***12.2%***

Missouri information developed by the Office of Admininstration / Division of Budget and Planning May 1999
Illinois information developed by the Census Data and Users Service, Illinois State University (1998)

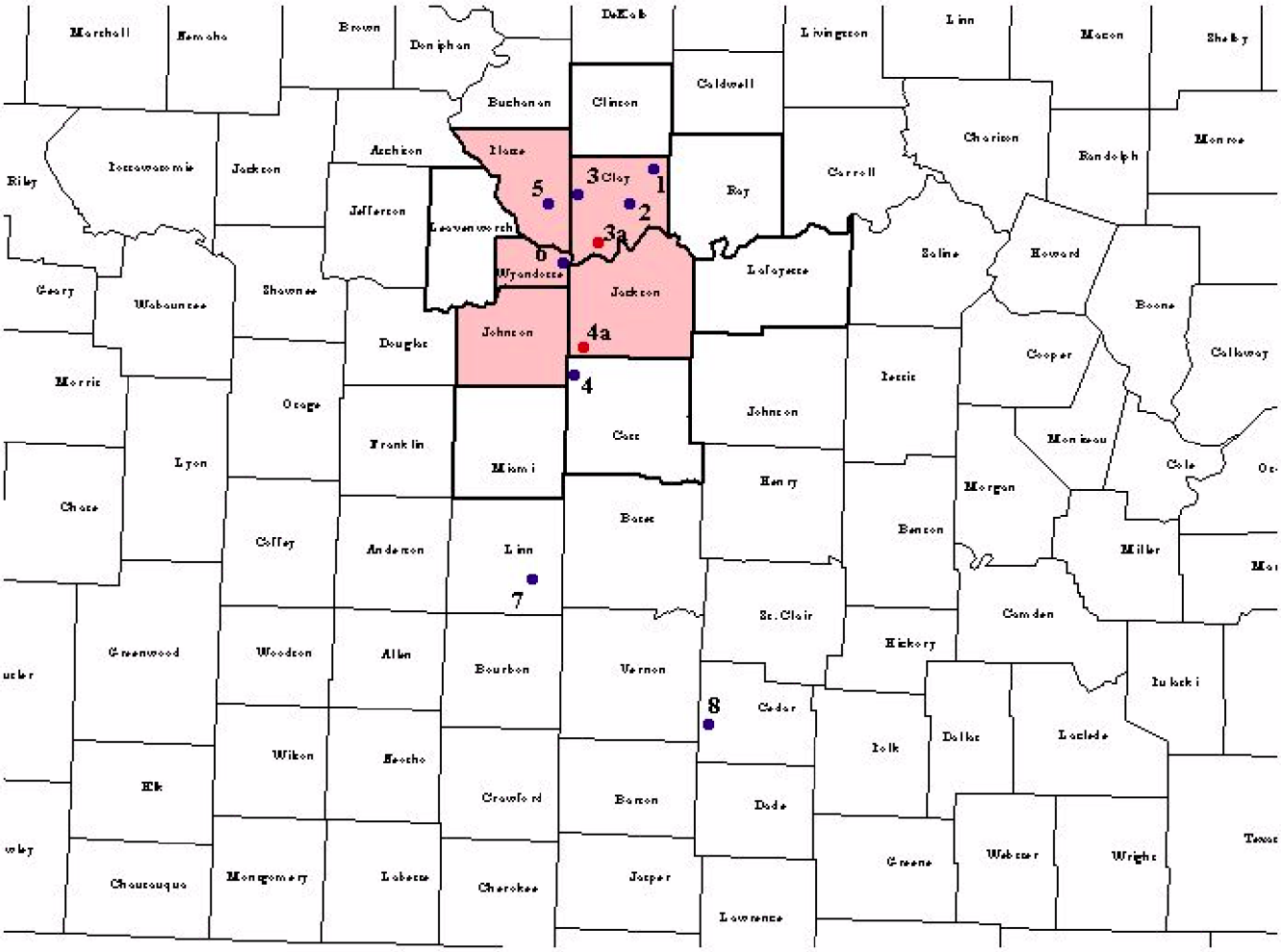
Table 10: Place of Residence/Employment Matrix (County by County)

Residence	Employment (MO)														Missouri
MISSOURI	Crawford	Franklin	Gasconade	Jefferson	Lincoln	Montgomery	Pike	St. Charles	St. Francois	St. Louis	StL City	Ste. Genevieve	Warren	Washington	Total
ST. LOUIS	24	1,752	46	5,463	116	27	11	12,859	89	358,742	105,207	30	180	33	484,579
ST. LOUIS CITY	17	291	0	1,181	12	0	0	1,439	32	50,997	82,480	0	45	0	136,494
ST. CHARLES	7	555	15	380	729	38	85	70,058	6	62,353	10,930	0	722	0	145,878
JEFFERSON	3	1,013	5	34,331	35	4	0	1,291	410	42,181	15,947	123	24	130	95,497
FRANKLIN	451	27,161	750	780	15	11	0	766	0	11,842	2,253	3	343	17	44,392
LINCOLN	0	40	0	23	8,314	45	229	5,529	0	2,738	702	0	465	0	18,085
WARREN	13	879	24	18	185	204	2	2,967	6	1,972	311	0	5,176	7	11,764
Missouri MSA	515	31,691	840	42,176	9,406	329	327	94,909	543	530,825	217,830	156	6,955	187	936,689
St. Francois	7	79	0	1,496	0	0	1	81	15,798	1,473	896	341	0	504	20,676
Washington	94	573	0	799	11	0	0	27	1,235	869	418	18	0	4,123	8,167
Crawford	5,371	1,728	208	60	0	0	0	65	13	733	206	0	0	76	8,460
Pike	0	0	0	5	474	40	5,167	294	0	146	106	0	61	0	6,293
Ste. Genevieve	0	15	0	679	0	0	0	43	896	620	366	4,922	0	22	7,563
Gasconade	52	1,103	4,337	4	6	109	0	46	0	427	107	0	77	0	6,268
Montgomery	2	155	306	0	73	3,007	16	362	0	231	29	0	569	0	4,750
Missouri TOTAL	6,041	35,344	5,691	45,219	9,970	3,485	5,511	95,827	18,485	535,324	219,958	5,437	7,662	4,912	998,866
ILLINOIS															
CLINTON	0	11	0	25	0	0	0	49	3	529	1,097	0	0	0	1,714
JERSEY	0	0	0	28	0	0	0	125	0	1,111	404	0	0	0	1,668
MADISON	0	136	8	288	11	0	9	1,051	0	16,780	14,499	10	7	0	32,799
MONROE	0	23	0	205	0	0	0	84	0	3,333	2,376	32	0	0	6,053
ST. CLAIR	0	130	0	304	3	0	0	640	13	12,582	18,251	0	10	0	31,933
Illinois MSA	0	300	8	850	14	0	9	1,949	16	34,335	36,627	42	17	0	74,167
TOTAL	6,041	35,644	5,699	46,069	9,984	3,485	5,520	97,776	18,501	569,659	256,585	5,479	7,679	4,912	1,073,033
TOTAL Workforce	6,674	36,230	6,386	46,679	10,231	3,826	6,604	98,677	20,350	580,137	262,981	6,154	7,828	5,107	1,097,864

Table 10: Place of Residence/Employment Matrix (County by County)

Employment (IL)							Total Resident	% Work in	% Work in	% Work in	% Work in
Clinton	Jersey	Madison	Monroe	St. Clair	Total IC		Who Work	NA Area	MSA	NAA+County	County
153	16	3,801	264	4,342	493,155	498,319	98.8%	98.9%	98.8%	72.0%	
17	0	1,253	50	1,449	139,263	140,747	98.9%	98.9%	98.9%	58.6%	
27	11	735	21	884	147,556	149,111	97.9%	98.9%	97.9%	47.0%	
20	0	489	134	857	96,997	98,030	98.2%	98.3%	98.2%	35.0%	
27	0	145	12	239	44,815	45,363	95.2%	96.1%	95.2%	59.9%	
10	0	35	27	53	18,210	18,386	49.7%	97.6%	95.0%	45.2%	
0	0	43	2	37	11,846	11,978	52.0%	96.8%	95.2%	43.2%	
254	27	6,501	510	7,861	951,842	961,934					
0	0	64	0	61	20,801	21,908	18.9%	18.9%	91.1%	72.1%	
0	0	0	0	0	8,167	8,526	31.5%	31.6%	79.9%	48.4%	
0	0	31	0	21	8,512	9,509	29.9%	29.9%	86.4%	56.5%	
2	0	8	0	15	6,318	7,457	7.7%	14.9%	77.0%	69.3%	
0	0	0	12	13	7,588	8,343	21.0%	21.0%	79.9%	59.0%	
0	0	0	18	1	6,287	6,960	24.5%	25.7%	86.8%	62.3%	
0	0	9	0	0	4,759	5,419	14.5%	26.4%	70.0%	55.5%	
256	27	6,613	540	7,972	1,014,274	1,030,056					
8,567	0	1,598	20	2,586	14,485	17,084	34.6%	84.8%	84.8%	50.1%	
0	4,473	3,480	0	111	9,732	10,223	51.4%	95.2%	95.2%	43.8%	
460	506	75,494	70	9,317	118,646	121,852	96.5%	97.3%	96.5%	62.0%	
0	0	421	5,367	1,730	13,571	14,392	94.1%	94.1%	94.1%	37.3%	
479	30	7,044	916	70,379	110,781	113,479	97.2%	97.6%	97.2%	62.0%	
9,506	5,009	88,037	6,373	84,123	267,215	277,030					
9,762	5,036	94,650	6,913	92,095	1,281,489	1,307,086					
12,605	6,116	102,971	7,535	96,181	1,323,272						

FIGURE 1 - MONITORING LOCATIONS IN THE KANSAS CITY AREA



Current Monitors

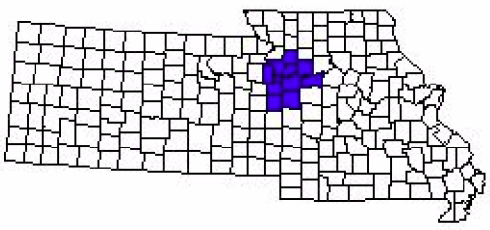
1 Watkins Mill State Park
2 Liberty
3 Rocky Creek
4 Richards Gebaur - South
5 KCI Airport
6 JFK - Wyandotte Co (KS)
7 Mine Creek (KS)
8 El Dorado Springs

Relocated Monitors

3a Worlds of Fun
4a Richards Gebaur

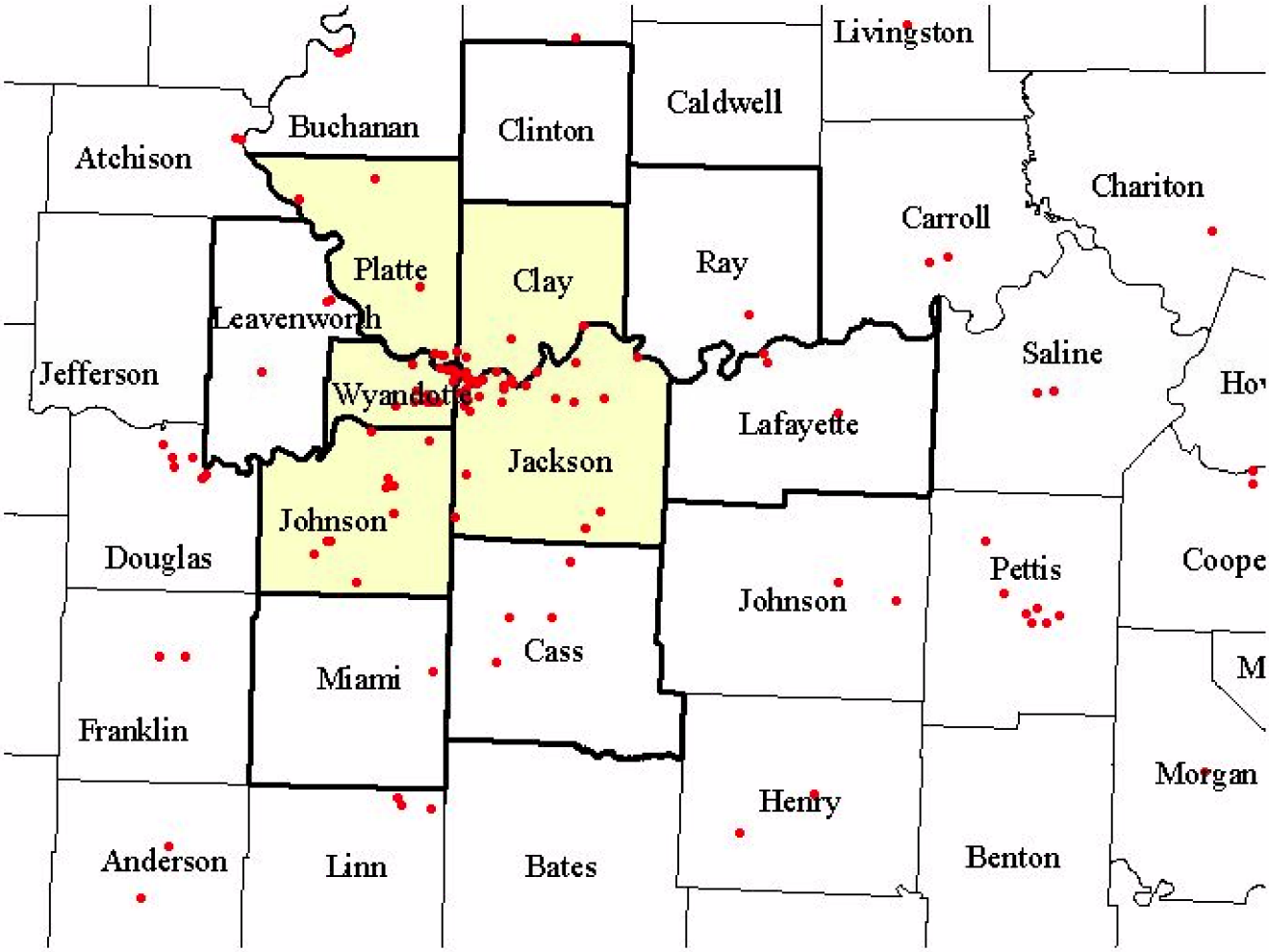
MSA

KC Maintenance Area

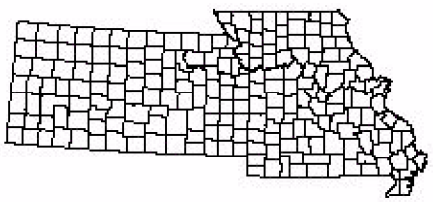


Missouri Department of Natural Resources
Air and Land Protection Division
Air Pollution Control Program
Cartography by Donald Cripe, January 2003

FIGURE 2 - VOC AND NOx POINT SOURCES KANSAS AND MISSOURI

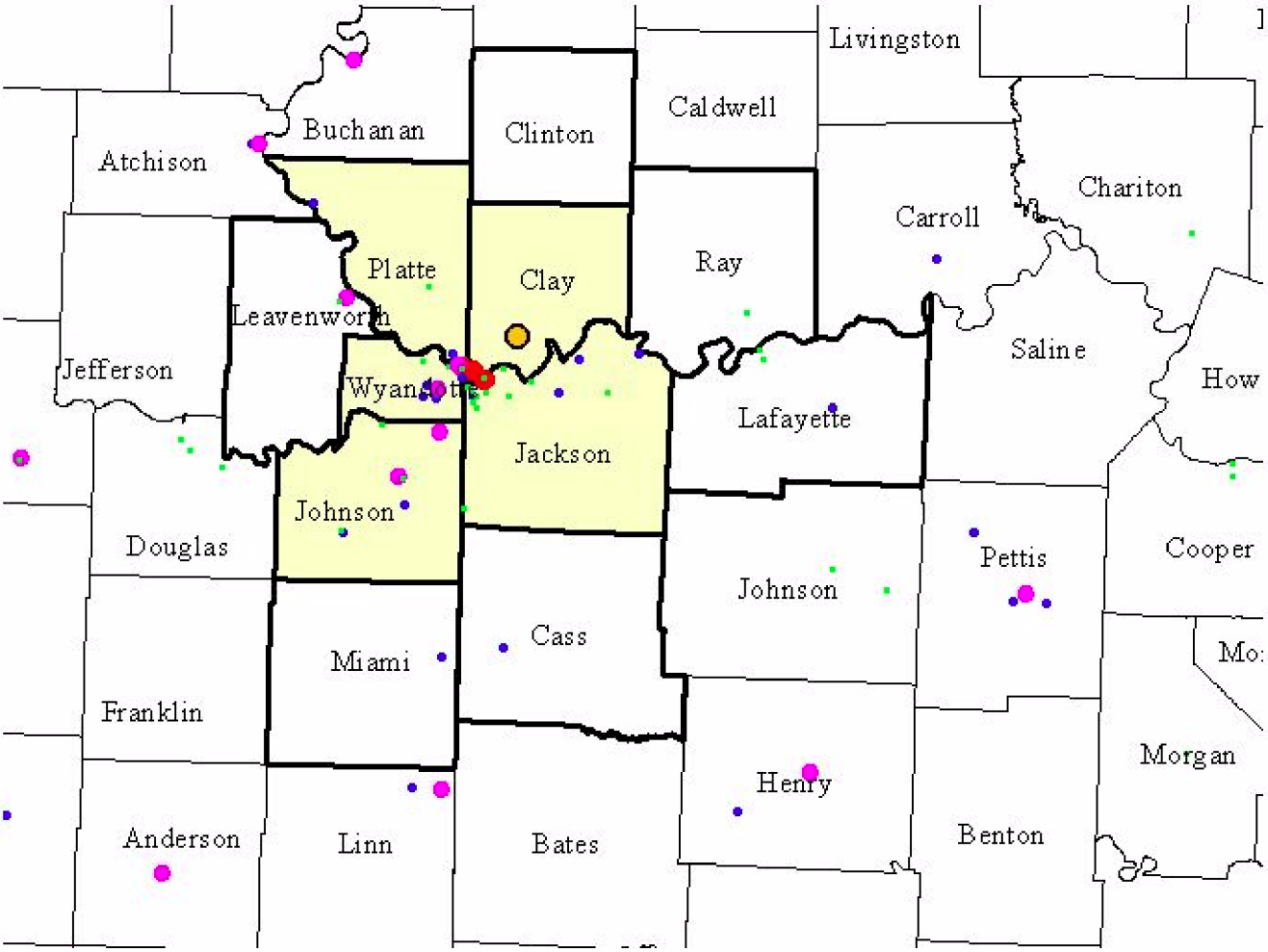


- VOC or NOx Point Source
- MSA
- KC Maintenance Area



Missouri Department of Natural Resources
Air and Land Protection Division
Air Pollution Control Program
Cartography by Donald Cripe, January 2003

FIGURE 3 - VOC POINT SOURCES KANSAS AND MISSOURI



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Air and Land Protection Division
Air Pollution Control Program
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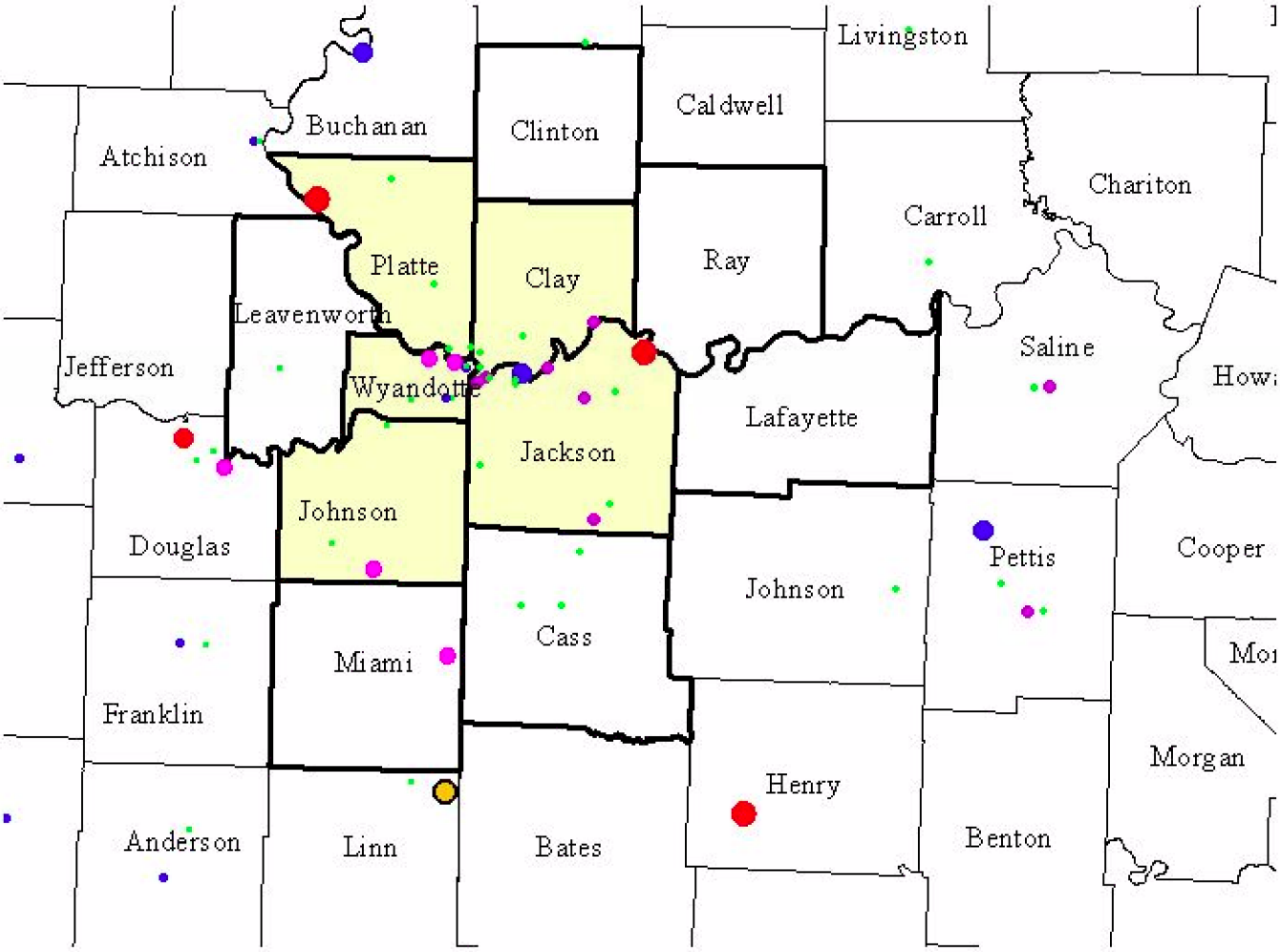
FIGURE 4 - NOx POINT SOURCES KANSAS AND MISSOURI



MSA

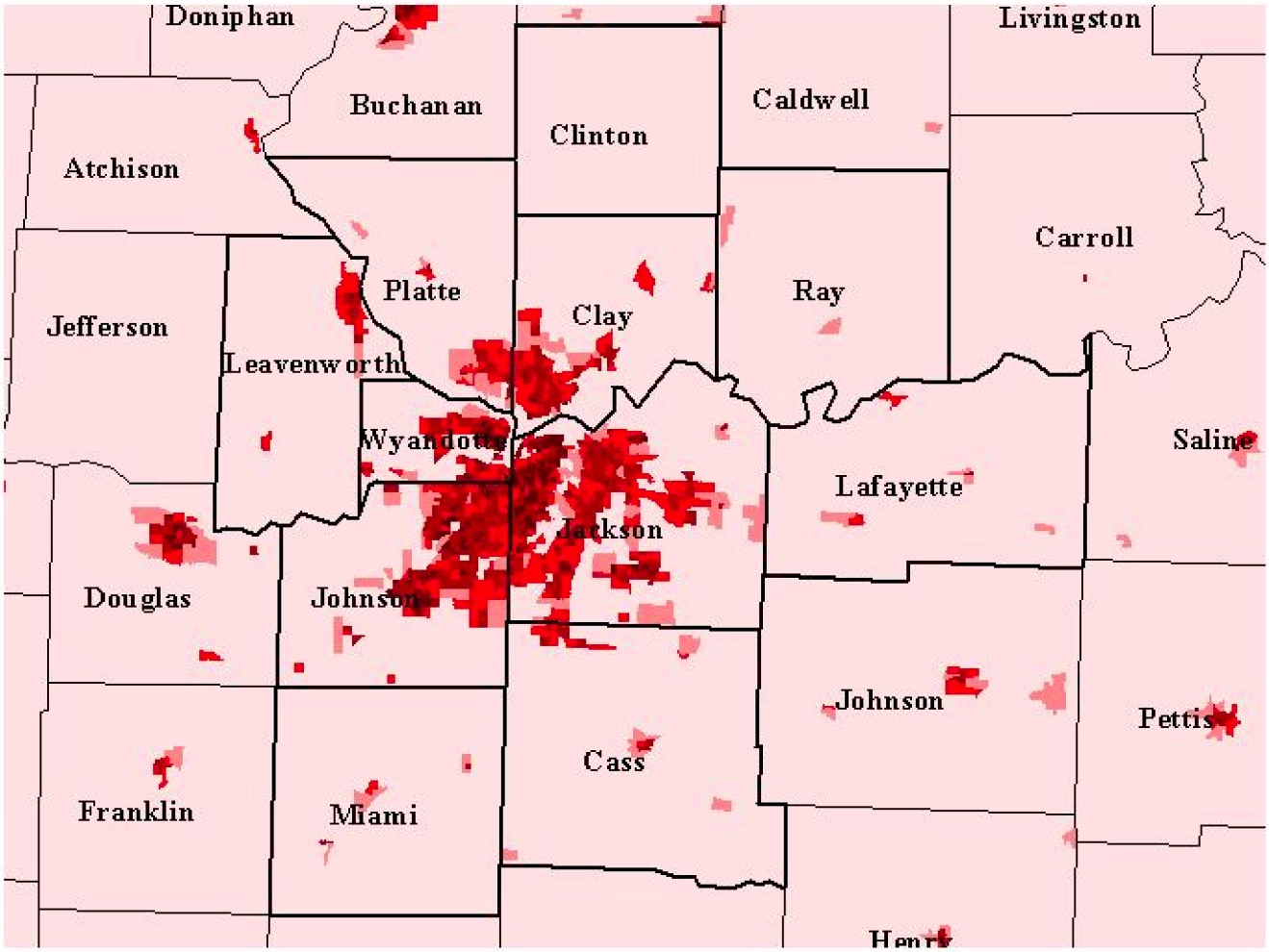
KC Maintenance Area

NOx Emissions in TPY

- **25-100**
- **100-1,000**
- **1,000-5,000**
- **5,000-25,000**
- **25,000+**

Missouri Department of Natural Resources
Air and Land Protection Division
Air Pollution Control Program
Cartography by Donald Cripe, January 2003

FIGURE 5 - POPULATION DENSITY FOR COUNTIES IN THE KANSAS CITY AREA (2000)



Population Density

- 0 - 500
- 500 - 1000
- 1000 - 2500
- 2500 - 5000
- 5000+

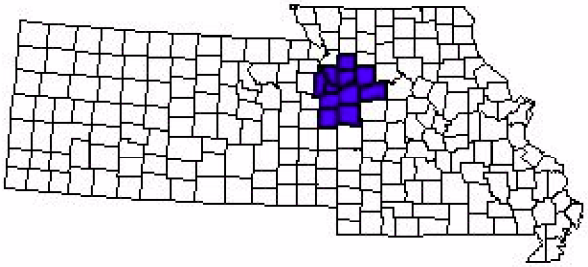


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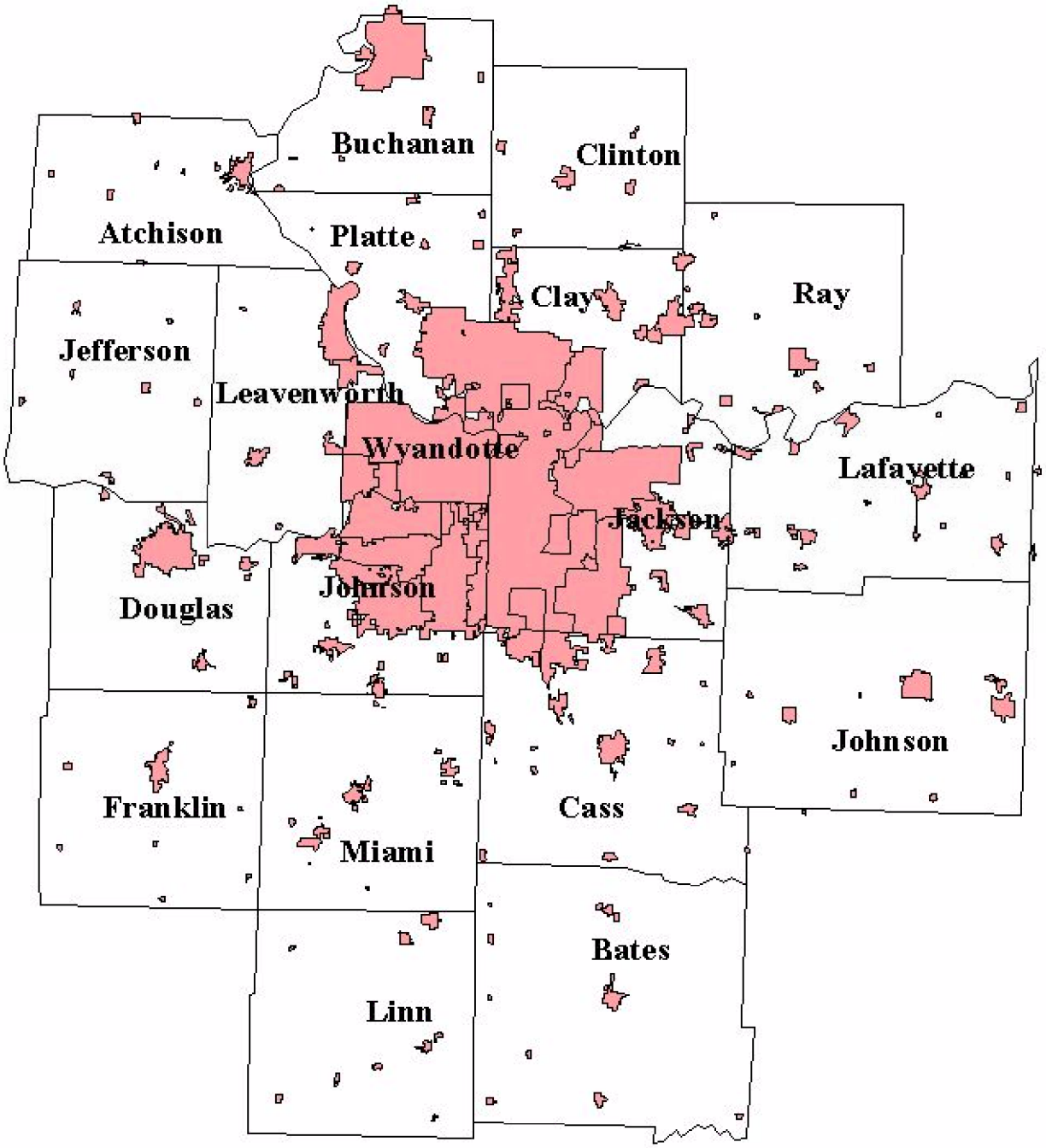
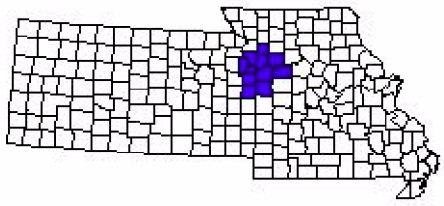
FIGURE 6 - DEGREE URBANIZATION IN THE KANSAS CITY AREA (2000)



Urban Areas



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Air Pollution Control Program
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FIGURE 7 - 2001 TRAFFIC COUNT FOR MISSOURI COUNTIES IN THE KANSAS CITY AREA

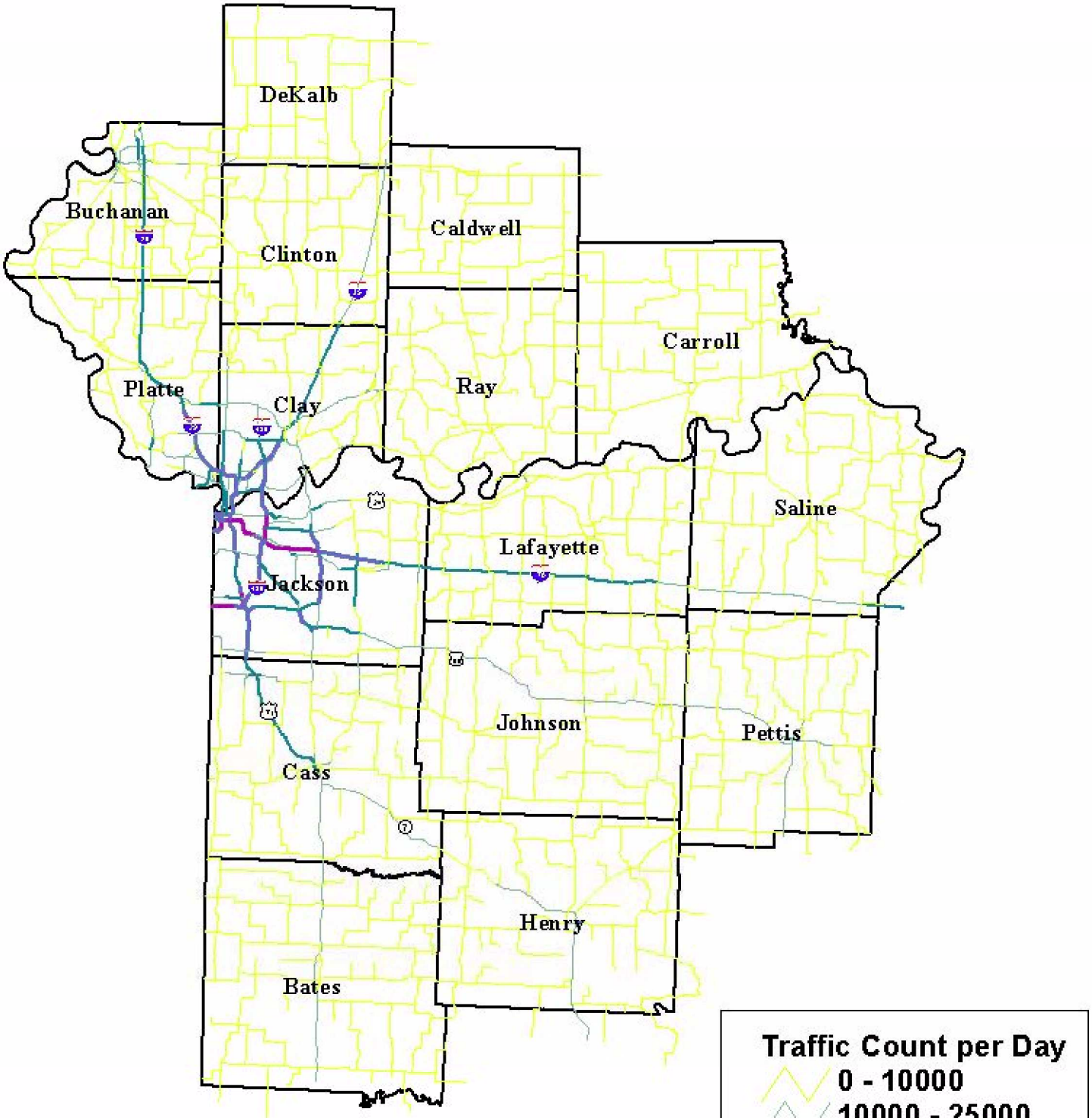

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Figure 8

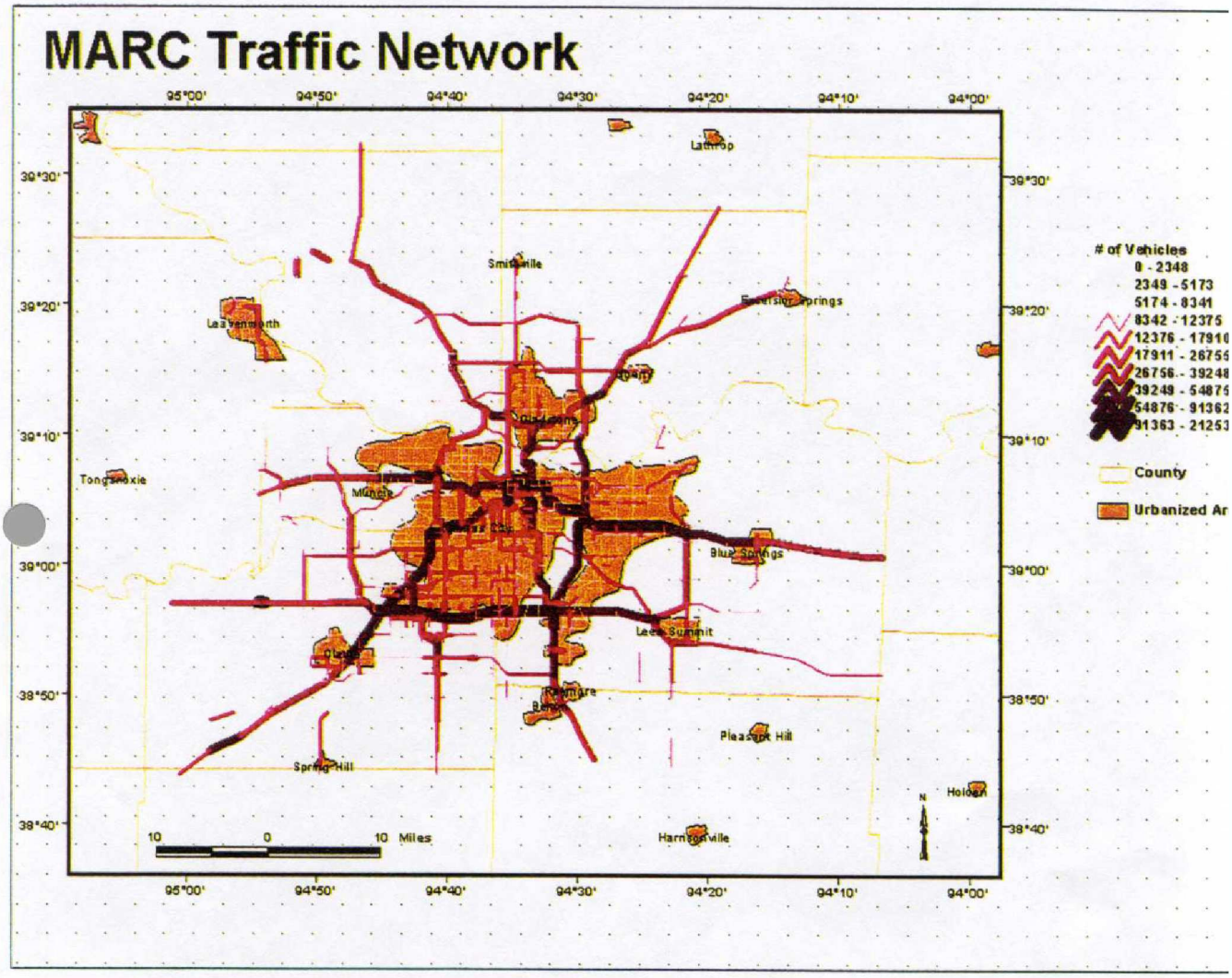
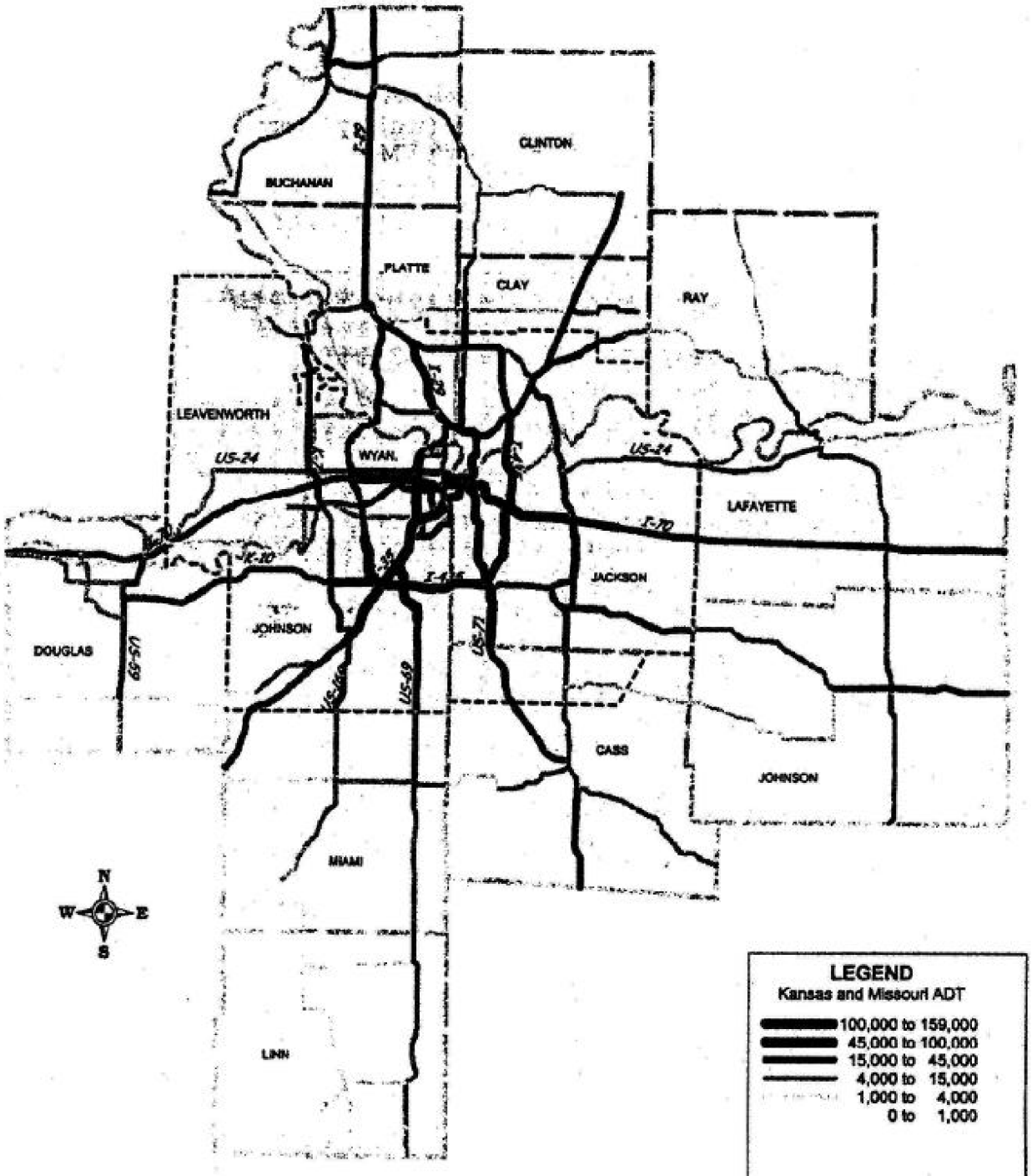

MARC Traffic Network
95°00'
94°50'
94°40'
94°30'
94°20'
94°10'
94°00'
39°30'
39°20'
39°10'
39°00'
38°50'
38°40'
Lathrop
Smithville
Leavenworth
Tonganoxie
Blue Springs
Lees Summit
Pleasant Hill
Spring Hill
Holden
Harrisonville
10 0 10 Miles
N
# of Vehicles
0 - 2348
2349 - 5173
5174 - 8341
8342 - 12375
12376 - 17910
17911 - 26755
26756 - 39248
39249 - 54875
54876 - 91362
91363 - 21253
County
Urbanized Ar

FIGURE 9

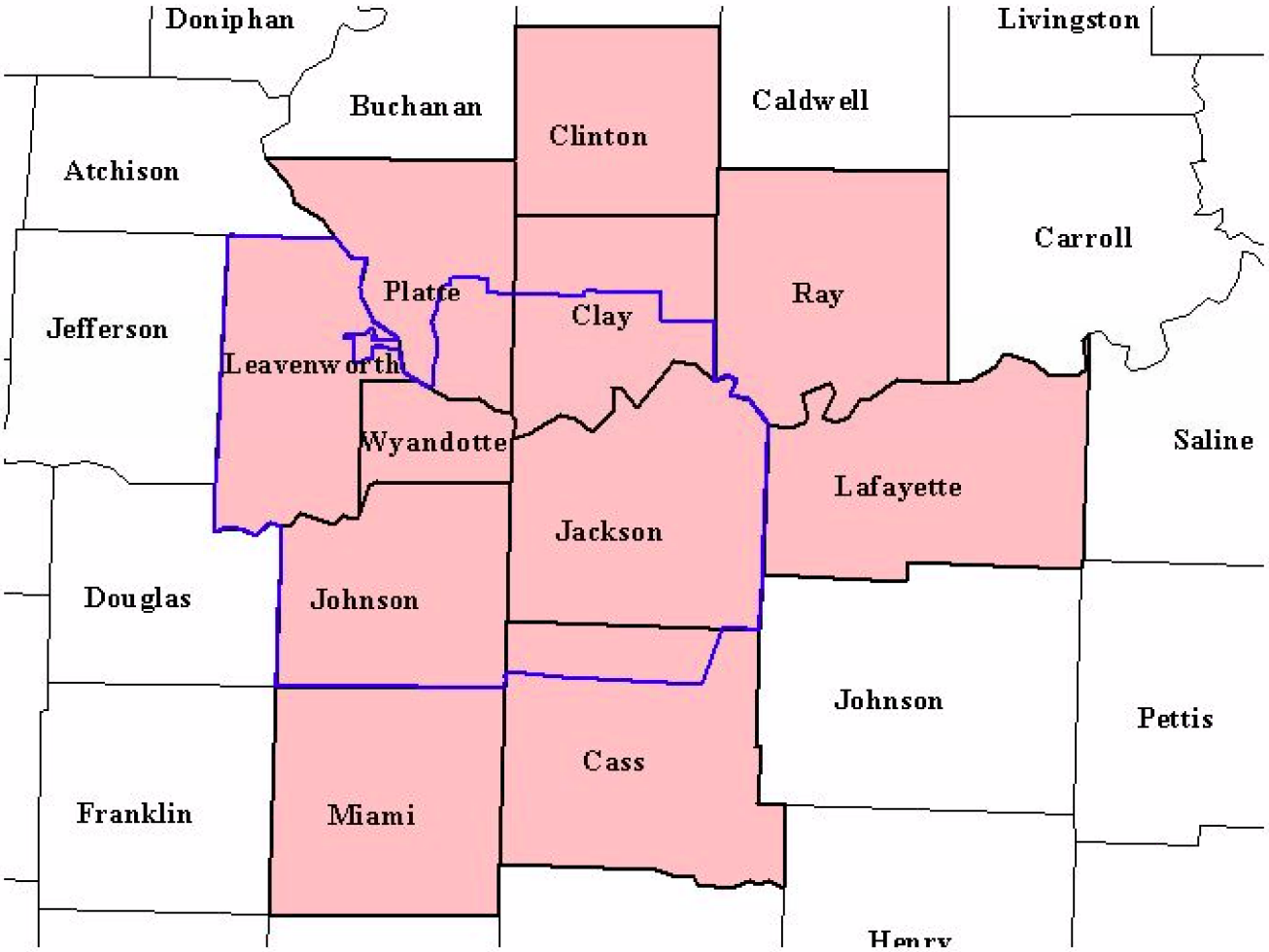
1998-1999 TRAFFIC COUNTS



MARC

k:\maninfo\airquality\CTPP Route Traffic Counts\CTTP Route Traffic Counts 05/26/00

FIGURE 10 - MPO AND URBAN AREAS IN THE KANSAS CITY AREA



MPO BOUNDARY

MSA

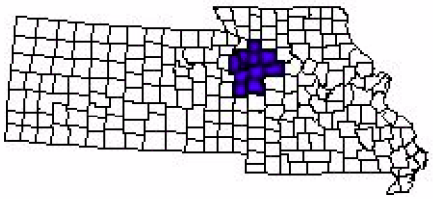


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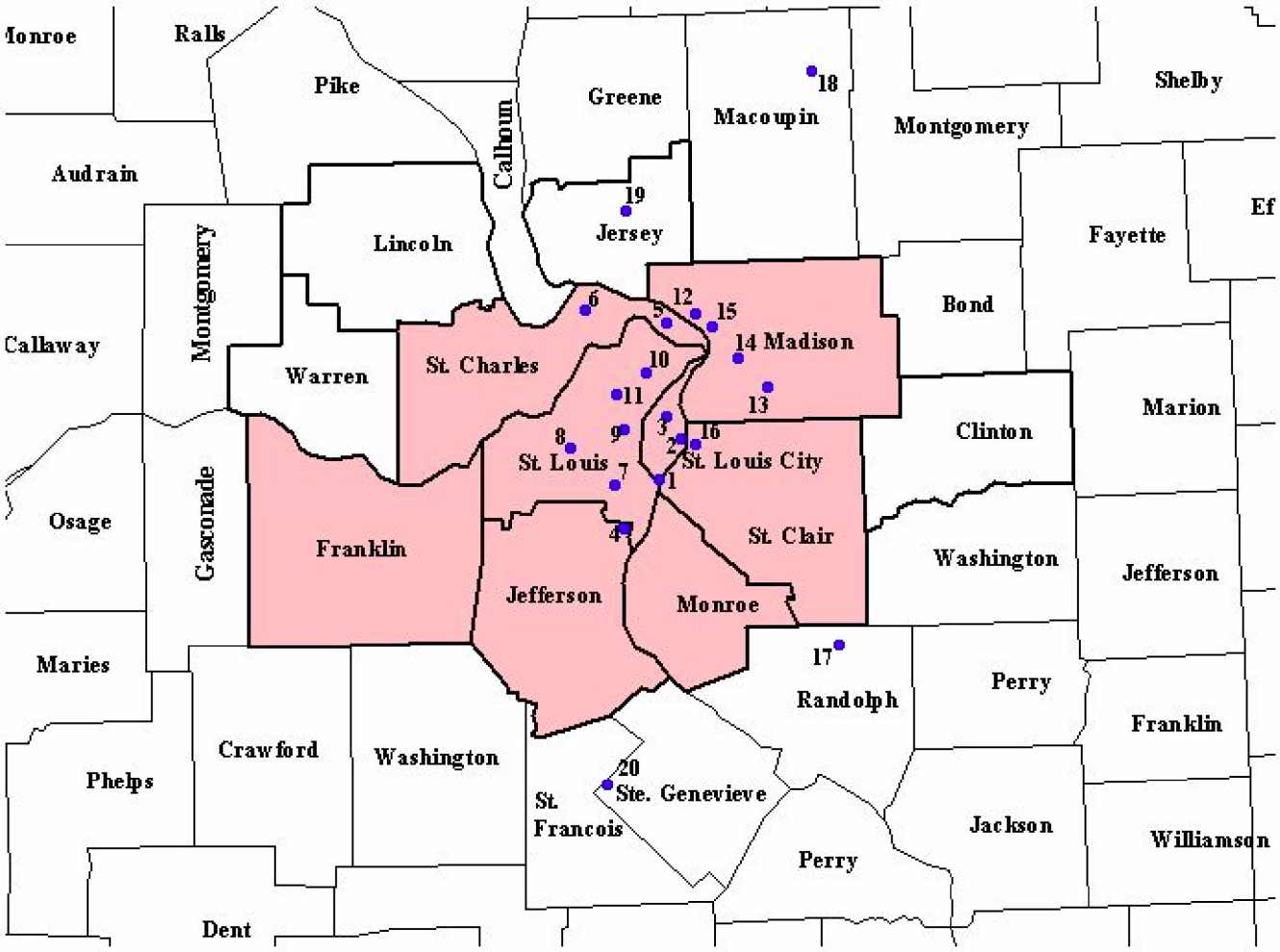
FIGURE 11 - CURRENT MONITORING LOCATIONS IN THE ST. LOUIS AREA



● Current Monitors

1	South Broadway	11	Breckenridge Hills
2	Clark	12	Alton (IL)
3	Margaretta	13	Maryville (IL)
4	Arnold	14	Edwardsville (IL)
5	West Alton	15	Wood River (IL)
6	Orchard Farm	16	E. St. Louis (IL)
7	Sunset Hills	17	Houston (IL)
8	Queeny Park	18	Nilwood (IL)
9	Ladue	19	Jerseyville (IL)
10	Ferguson	20	Bonne Terre

MSA

STL Non-Attainment Area

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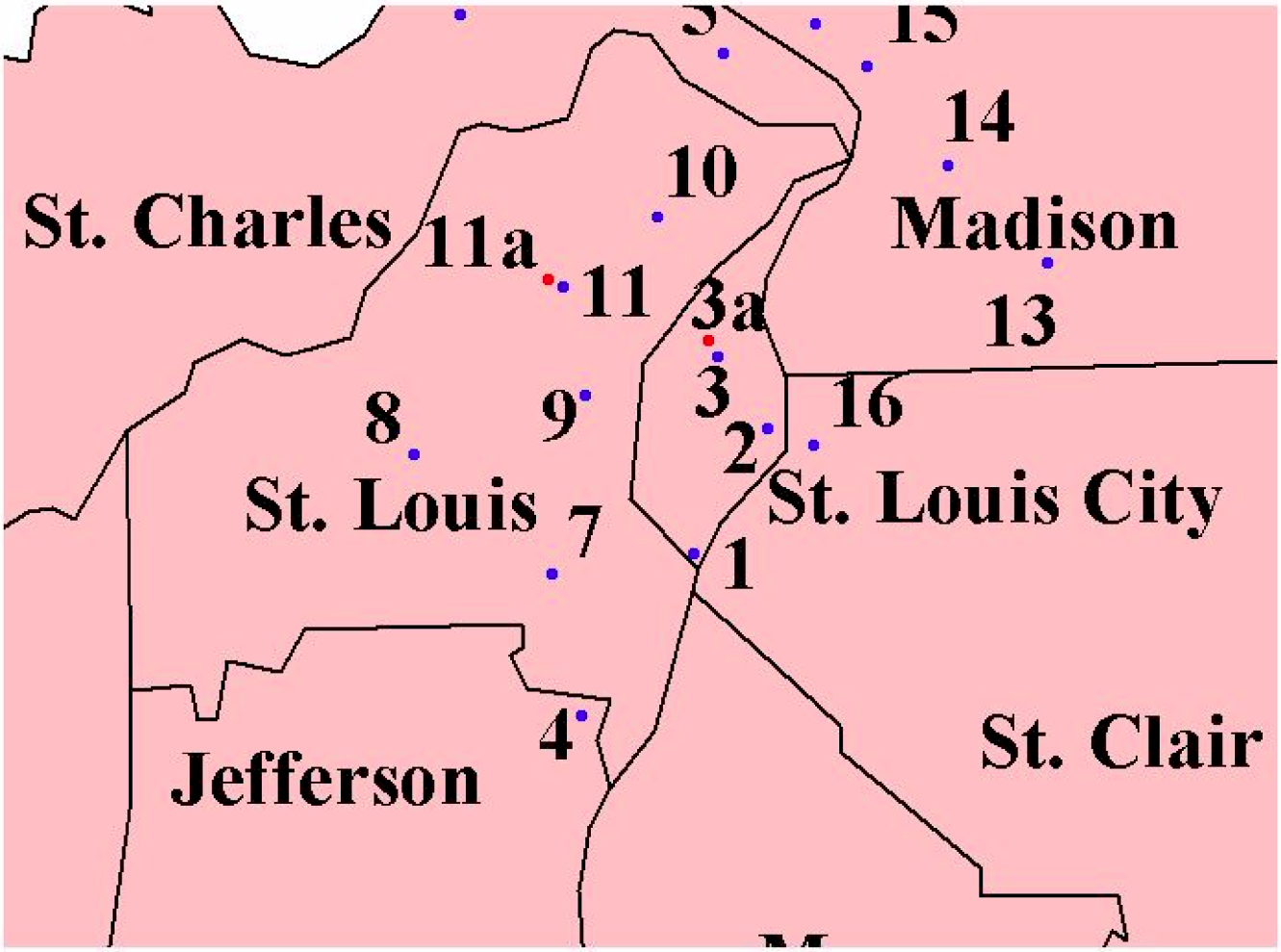
FIGURE 12 - RELOCATED MONITORING SITES IN THE ST. LOUIS AREA



● Current Monitors

1	South Broadway	9	Ladue
2	Clark	10	Ferguson
3	Margaretta	11	Breckenridge Hills
4	Arnold	13	Maryville (IL)
7	Sunset Hills	14	Edwardsville (IL)
8	Queeny Park	16	E. St. Louis (IL)

MSA

STL Non-Attainment Area

● Relocated Monitors

3a	Newstead	11a	St. Ann

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FIGURE 13

Low-level Point Source VOC Emissions

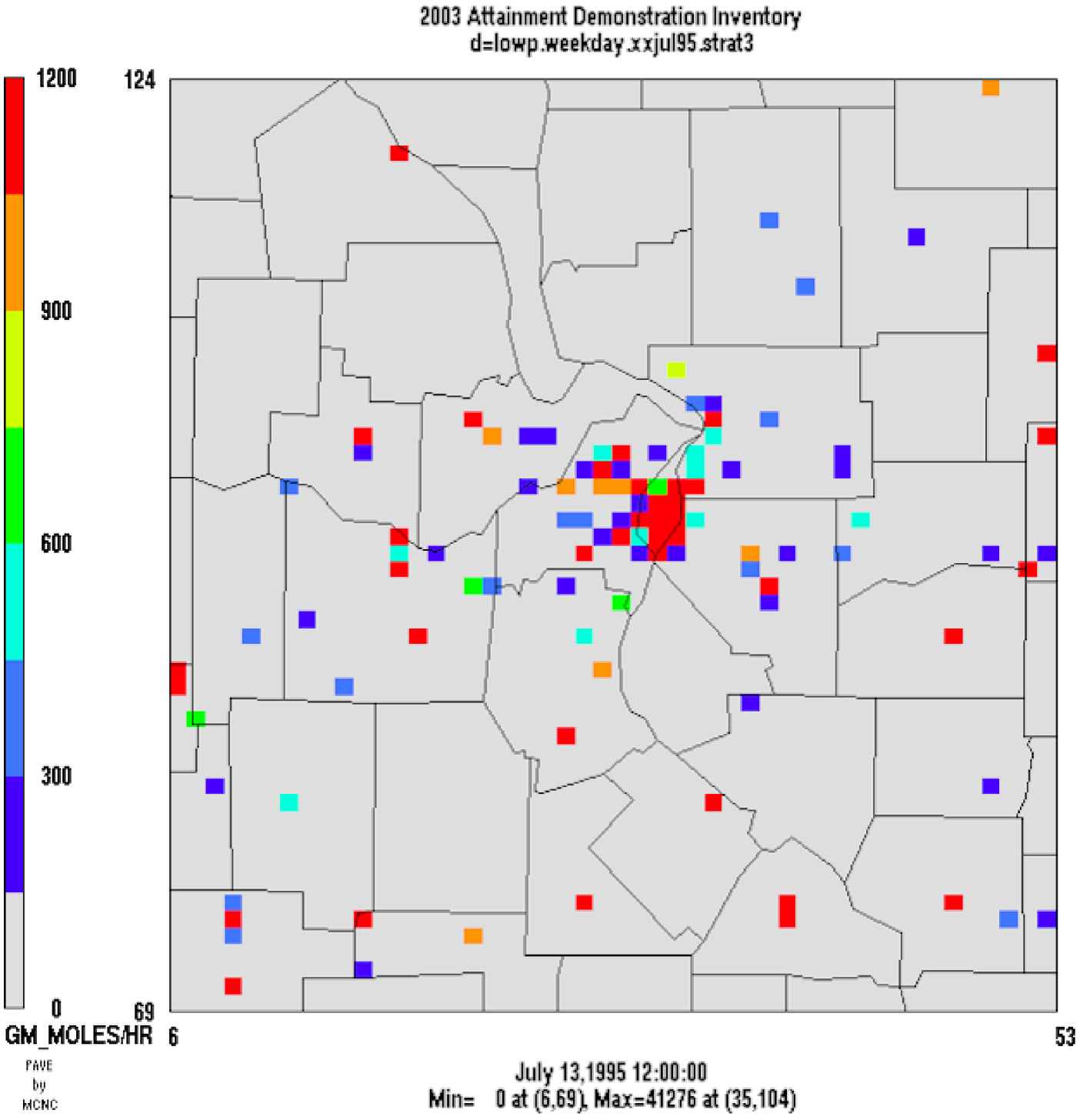


Figure 14

Area Source VOC Emissions

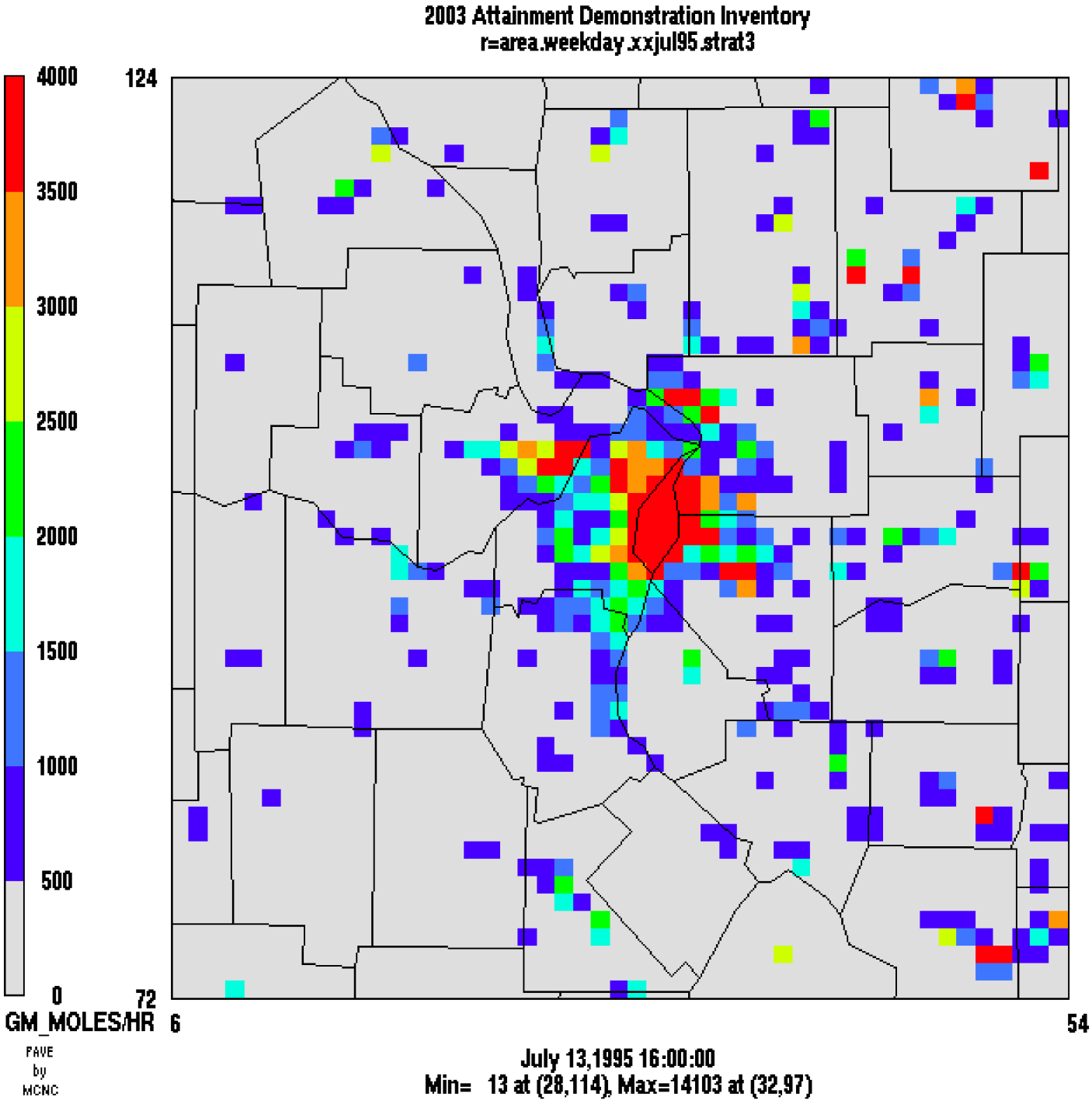


FIGURE 15

Mobile Source VOC Emissions

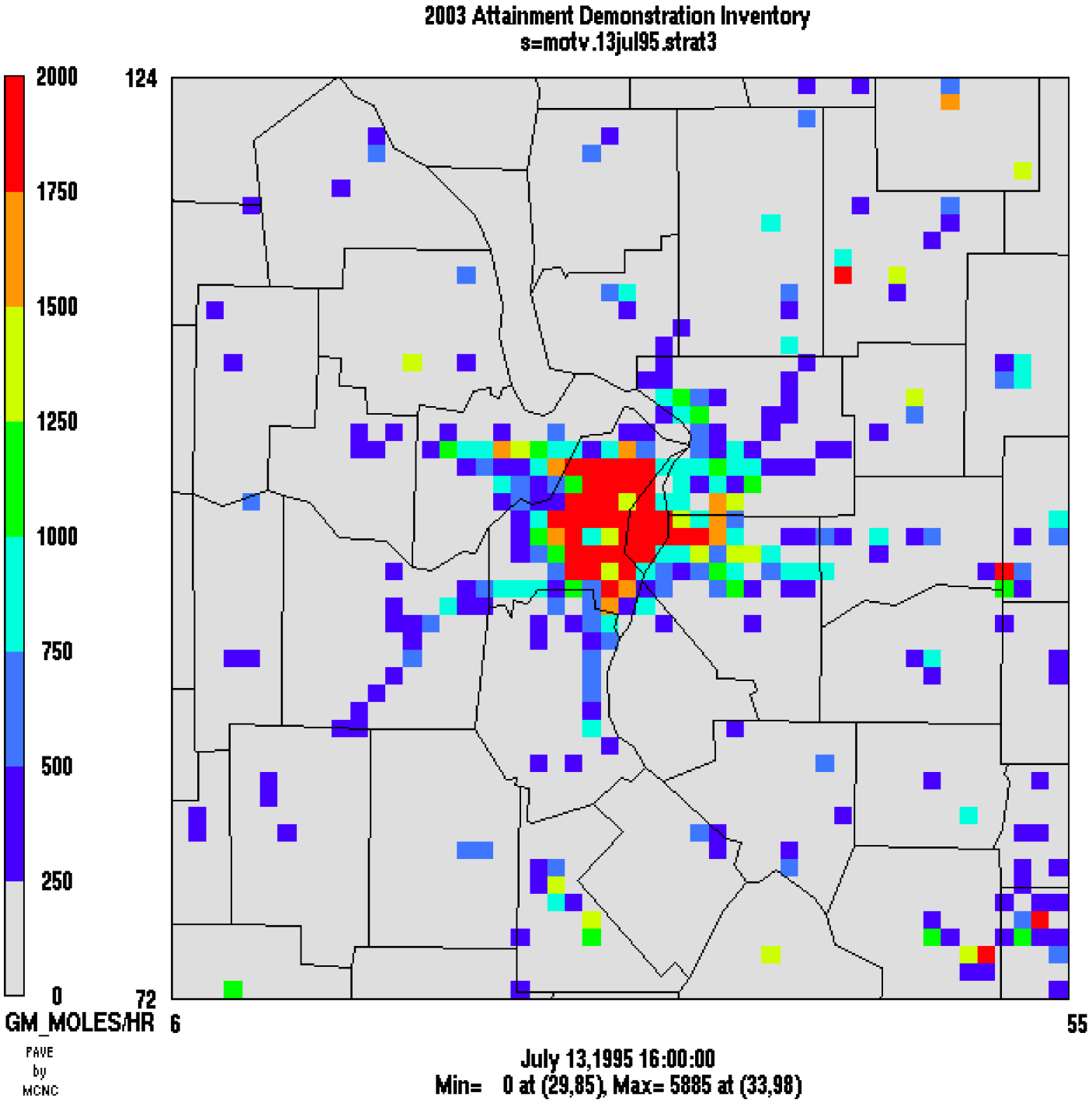


FIGURE 16

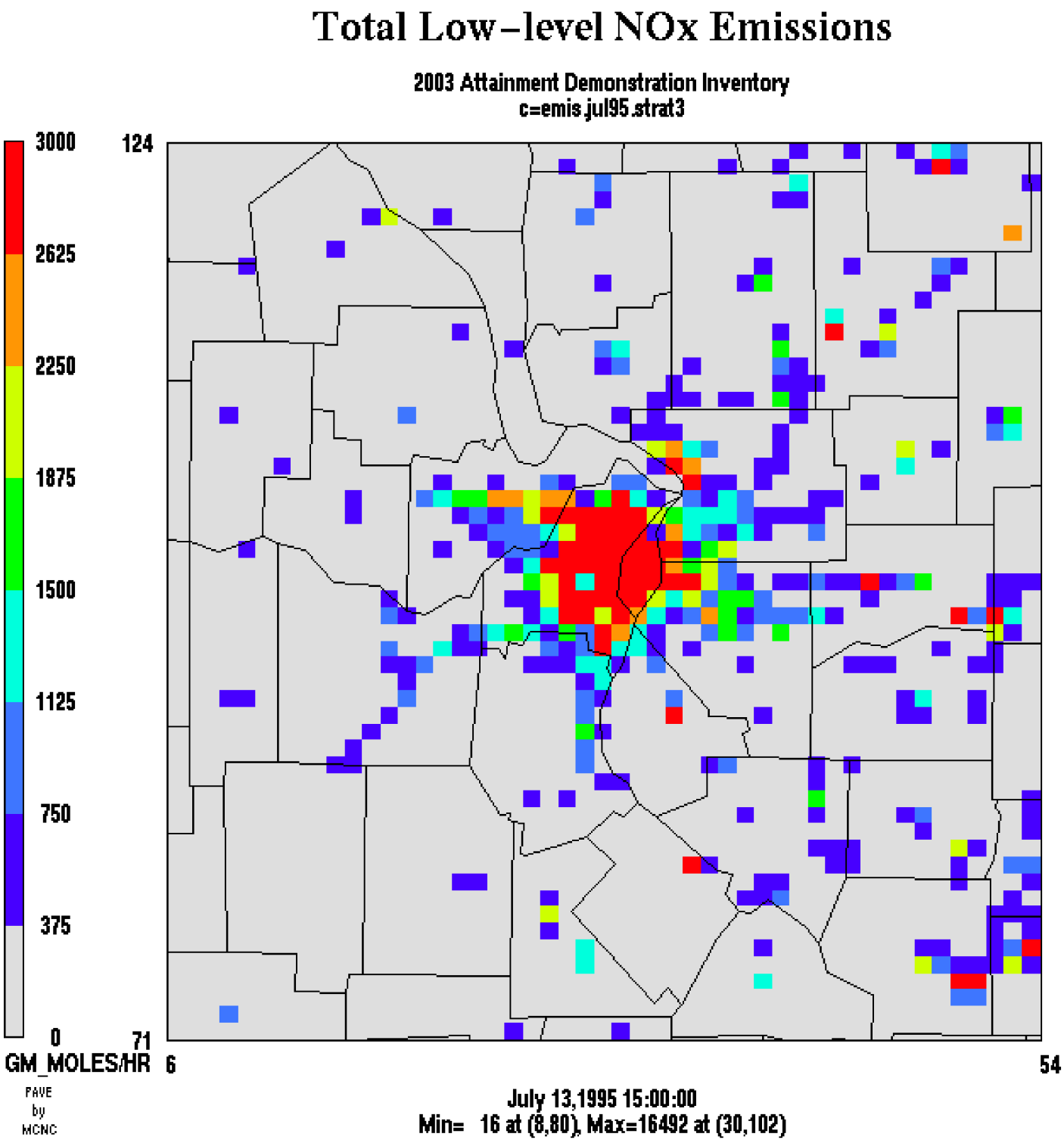

Total Low-level NOx Emissions
2003 Attainment Demonstration Inventory
c=emis.jul95.strat3
3000
2625
2250
1875
1500
1125
750
375
0
124
71
GM_MOLES/HR
PAVE
by
MCNC
6
54
July 13,1995 15:00:00
Min= 16 at (8,80), Max=16492 at (30,102)

FIGURE 17

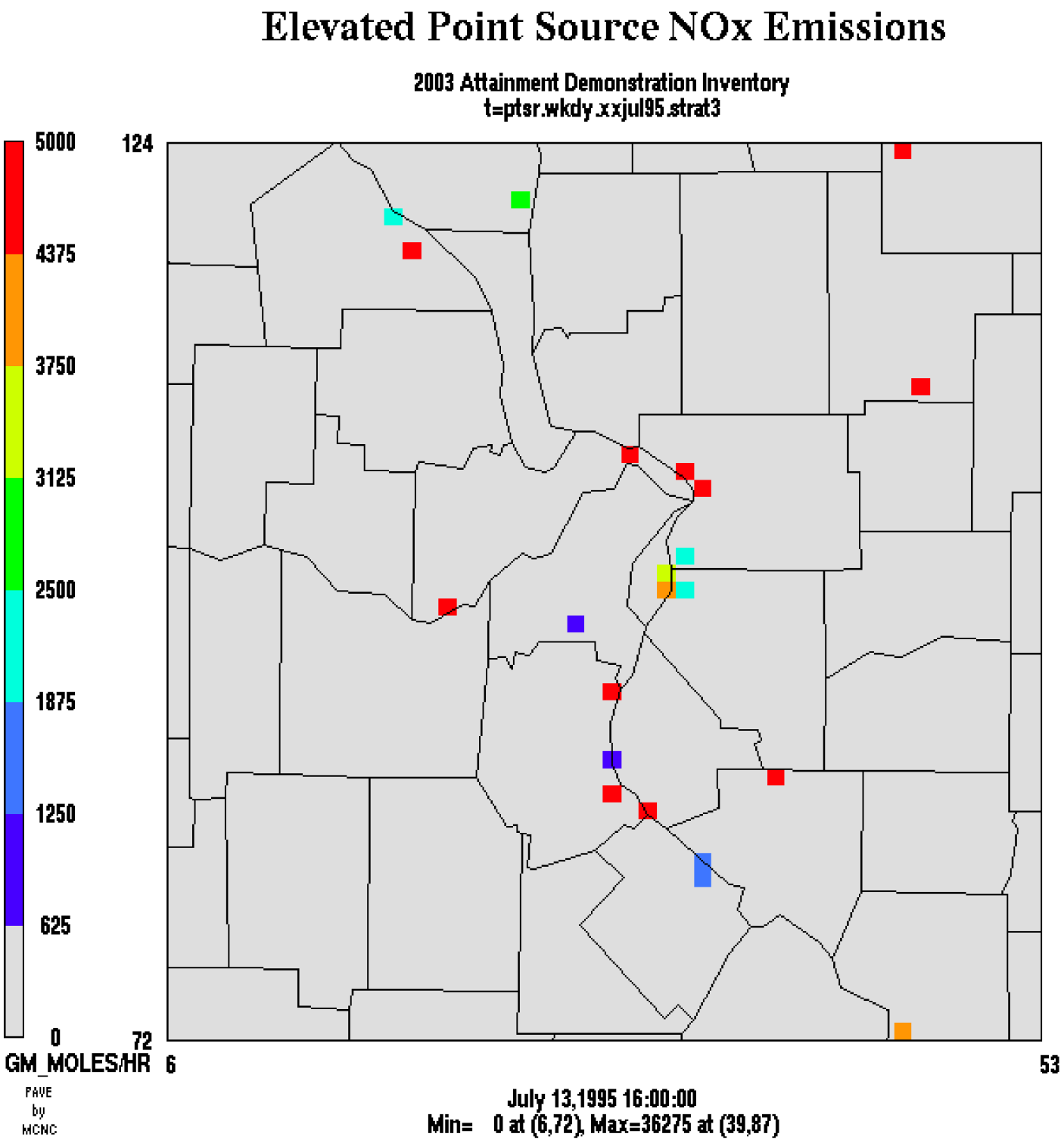
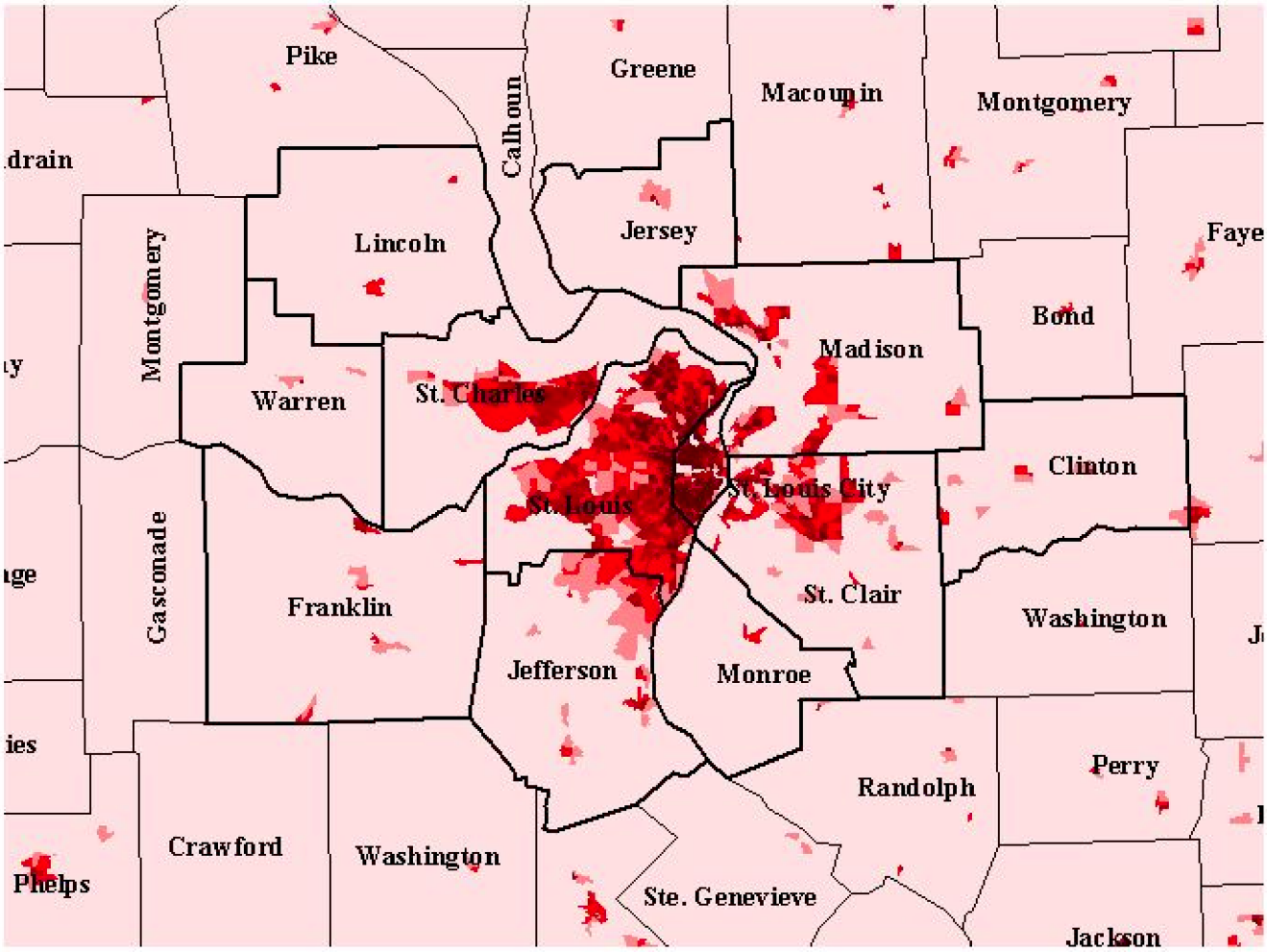

Elevated Point Source NOx Emissions
2003 Attainment Demonstration Inventory
t=ptsr.wkdy.xxjul95.strat3
5000
4375
3750
3125
2500
1875
1250
625
0
GM_MOLES/HR
PAVE
by
MCNC
124
72
6
53
July 13,1995 16:00:00
Min= 0 at (6,72), Max=36275 at (39,87)

FIGURE 18 - POPULATION DENSITY FOR COUNTIES IN THE ST. LOUIS AREA



Population Density

- 0 - 500
- 500.01 - 1000
- 1000.01 - 2500
- 2500.01 - 5000
- 5000+

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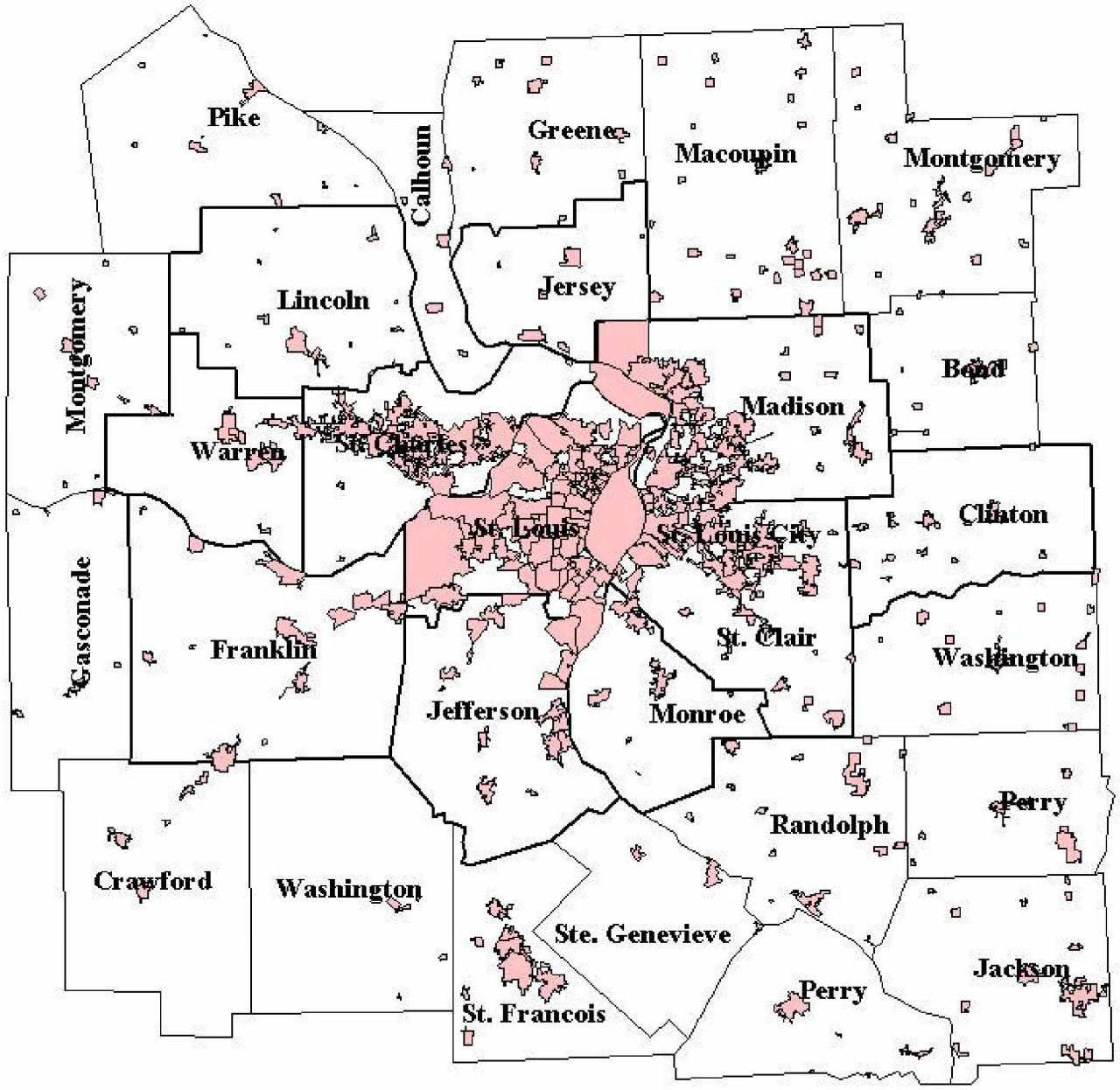
FIGURE 19 - DEGREE URBANIZATION IN THE ST LOUIS AREA



Urban Areas

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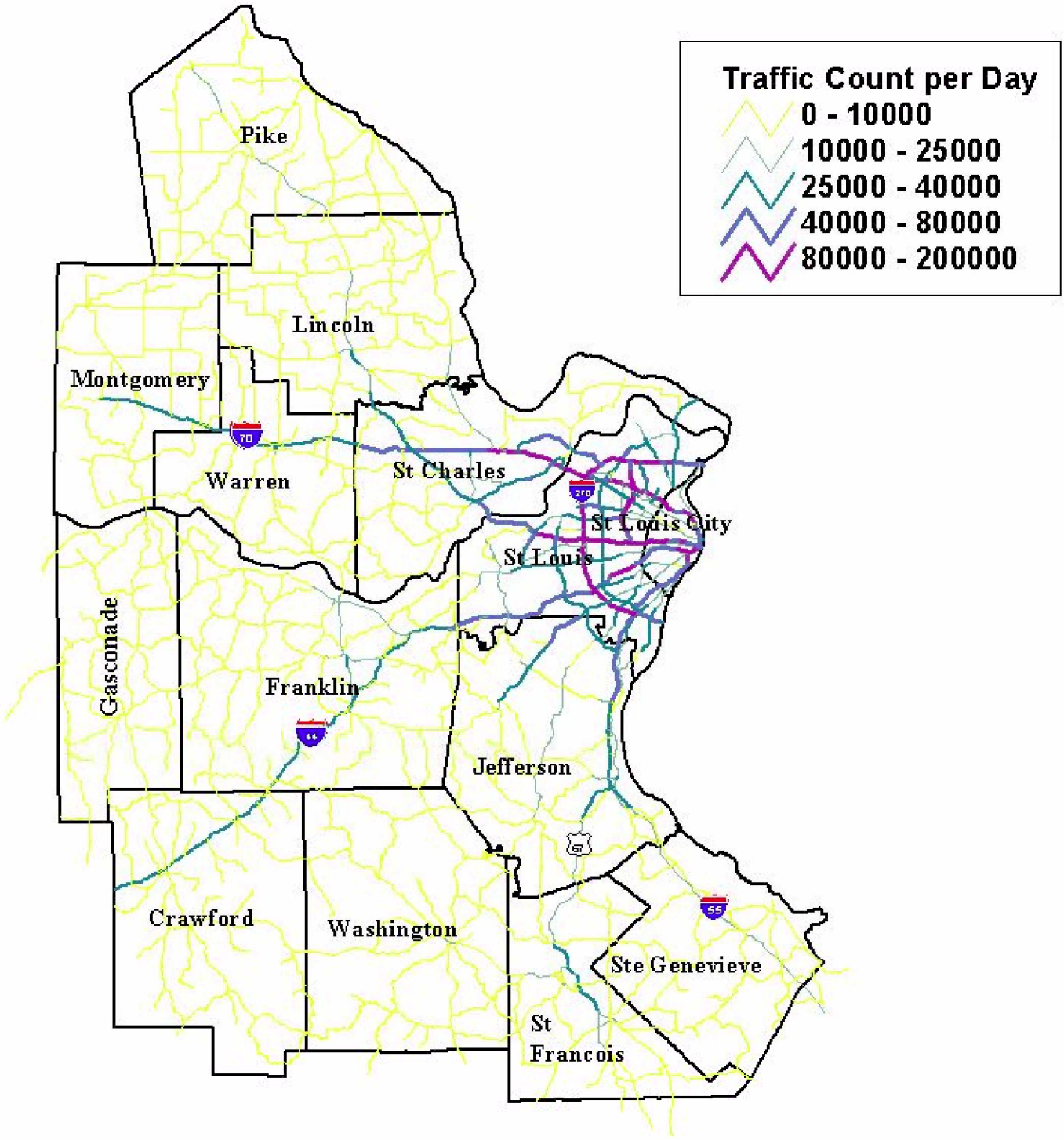
FIGURE 20 - 2001 TRAFFIC COUNT FOR MISSOURI COUNTIES IN THE ST. LOUIS AREA



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