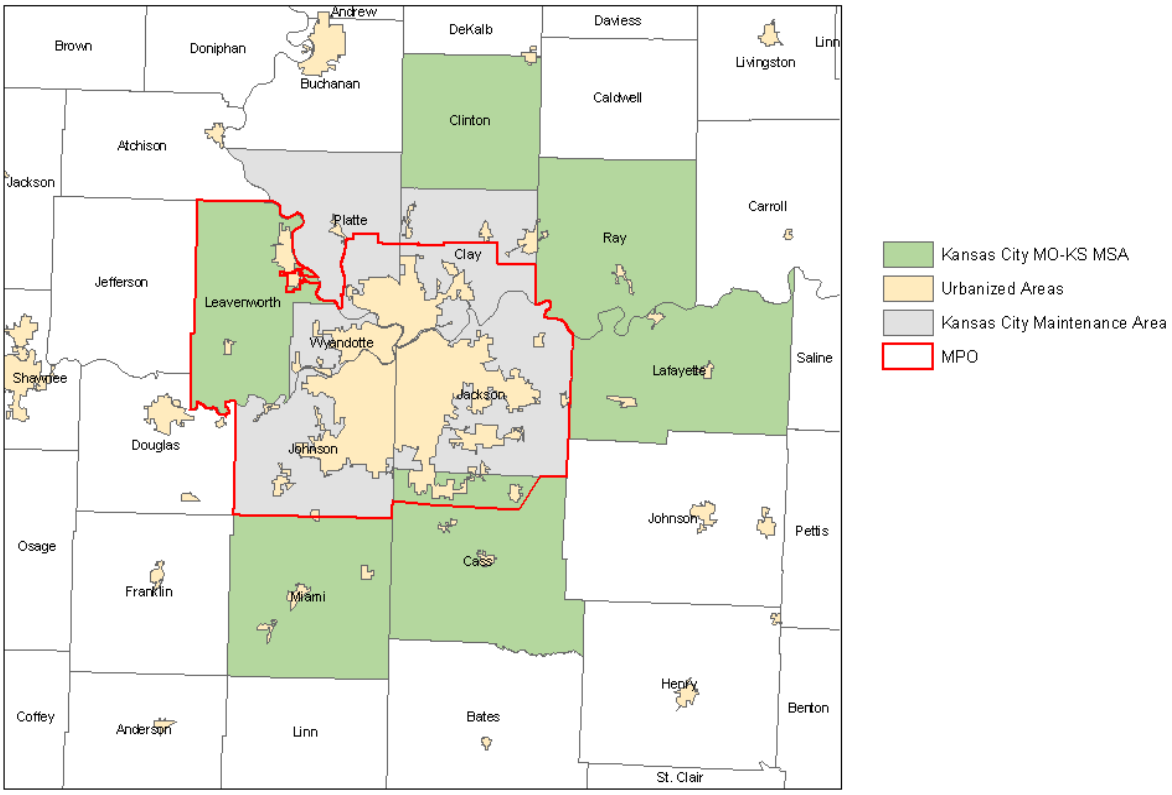
Technical Support Document for the Governor's Recommendation Regarding the 8-hour Ozone Standard Designation for the Kansas City Area

Kansas City Region Boundaries:
MSA, MPO, Maintenance Area and Urbanized Areas



Source: U.S. Census Bureau, U.S. Census 2000 boundary files. Mid-America Regional Council.

PREPARED BY THE KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT, BUREAU OF AIR AND RADIATION

JUNE, 2003

EXECUTIVE SUMMARY

The Bureau of Air and Radiation of the Kansas Department of Health and Environment (KDHE) prepared this document to inform and support the recommendation from the Governor of the State of Kansas to the U.S. Environmental Protection Agency (EPA) for designating the Kansas portion of the Kansas City area as nonattainment under the 8-hour ozone National Ambient Air Quality Standard (NAAQS). This document outlines the criteria against which each county in the Kansas City area was evaluated and presents the data and technical analysis that form the basis of the recommendation. The State of Missouri Department of Natural Resources is concurrently working on a technical support document for their Governor's reference in making recommendations regarding the designation of the Missouri counties of the Kansas City area.

Guidance from the EPA establishes the Metropolitan Statistical Area or Consolidated Metropolitan Statistical Area (C/MSA) as the presumptive boundary for 8-hour ozone nonattainment areas. The guidance also identifies eleven criteria for States to consider in determining whether to recommend nonattainment area boundaries that are larger or smaller than the C/MSA. The criteria are as follows:

1. Emissions and air quality in adjacent areas (including adjacent C/MSAs);
2. Population density and degree of urbanization including commercial development;
3. Monitoring data representing ozone concentrations in local areas and larger areas;
4. Location of emission sources;
5. Traffic and commuting patterns;
6. Expected growth;
7. Meteorology;
8. Geography/topography;
9. Jurisdictional boundaries;
10. Level of control of emission sources; and
11. Regional emission reductions.

The counties in the Kansas City MSA plus Douglas County were evaluated within this framework. The Kansas City MSA includes Johnson, Leavenworth, Miami and Wyandotte Counties in Kansas and Cass, Clay, Clinton, Jackson, Lafayette, Platte and Ray Counties in Missouri. Although not part of the Kansas City MSA, Douglas County was evaluated because it is of interest to EPA Region 7 staff.

The KDHE Bureau of Air and Radiation established a process for developing this support document that included significant consultation with the local officials, the State of Missouri Department of Natural Resources (MDNR), EPA Region 7 and the Mid-America Regional Council (MARC), which also served as a coordinator in getting the stakeholders together. Through the MARC Air Quality Forum, a technical workgroup was formed to evaluate the data to serve as the basis for the recommendation. The technical workgroup included staff from KDHE, MDNR, county officials, and was facilitated by the MARC staff. Staff from EPA Region 7 also observed. The information considered included air quality

monitoring data from 2000-2002; maps of ozone concentration gradients prepared using Surfer software; NOx and VOC emissions from MDNR, KDHE and EPA databases; meteorological data from the NOAA National Data Center (NNDC); wind roses produced with WRplot View software; population estimates from the 2000 Census; estimates of average daily vehicle miles traveled (VMT) from the Kansas and Missouri Departments of Transportation; and other data.

Of the eleven criteria in EPA's guidance, the three that most heavily influenced the recommendation were meteorological conditions, exposure to ozone concentrations in excess of the 8-hour ozone standard and emissions contribution to exceedances of the 8-hour ozone standard. The following table summarizes data gathered for these three criteria. It is intended to provide a snapshot view of how the three criteria apply to the counties that were evaluated. The footnote describes how the color codes were applied for each of the criteria.

CRITERIA	Meteorological Contribution	Precursor Emissions	Ozone Concentration
Kansas MSA Counties			
Johnson			
Leavenworth			
Miami			
Wyandotte			
Missouri MSA Counties			
Cass			
Clay			
Clinton			
Jackson			
Lafayette			
Platte			
Ray			
Other Kansas Counties			
Douglas			

Meteorological Contribution is based on wind roses and back trajectories; red designates meteorological conditions that contribute to ozone formation; green designates
Precursor Emissions are based on ranking of combined VOC and N0x emissions: red designates > 25,000 tons per year, yellow designates 10,000 to 25,000 tons per year green designates < 10,000 tons per year
Ozone concentration: red is a violation of the standard, yellow is any exceedance(s) of the standard during the three year period; green is no data or no measured exceedances of the standard.

Based on these criteria, it is recommended that Johnson and Wyandotte Counties be included in the Kansas City 8-hour ozone nonattainment area and that Leavenworth, Miami and Douglas Counties be excluded from the Kansas City nonattainment area.

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

TABLE OF CONTENTS iii

INTRODUCTION/BACKGROUND 1

METEOROLOGY OF OZONE FORMATION IN KANSAS CITY 7

COUNTY EVALUATIONS 10
- Sources of Data 10
- Kansas MSA Counties 13
  - *Johnson County* 13
  - *Leavenworth County* 17
  - *Miami County* 21
  - *Wyandotte County* 25
- Missouri MSA Counties 29
  - *Cass County* 29
  - *Clay County* 32
  - *Clinton County* 36
  - *Jackson County* 39
  - *Lafayette County* 43
  - *Platte County* 46
  - *Ray County* 50
- Kansas Non-MSA Counties 54
  - *Douglas County* 54
  - *Linn County/LaCygne Power Plant* 58

APPENDICES

Appendix A - Air Quality Data

Table A-1. 8-Hour Ozone Monitoring Data for Kansas City A-1
Table A-2. 8-Hour Ozone Exceedances in 2000, 2001 and 2002 . . . . . A-2
Figure A-3. Plot of 4th-Highest, 3-Year Average 8-Hour Ozone Concentrations Across Kansas (2000-2002) A-4
Figure A-4. Plot of 4th-Highest, 3-Year Average 8-Hour Ozone Concentrations in Kansas City Region (2000-2002) A-5

Appendix B - Emissions Data

Table B-1. Summary of Annual NOx and VOC Emissions in Kansas City Area Counties B-2
Figure B-1. 1999 Total NOx Emissions by County B-2
Figure B-2. 1999 NOx Point Source Emissions B-2
Figure B-3. 1999 Total VOC Emissions by County B-2
Figure B-2. 1999 VOC Point Source Emissions B-2
Table B-2. Kansas 1999 NOx and VOC Point Source Emissions by Facility . B-2
Table B-3. Missouri 1999 NOx and VOC Point Source Emissions by Facility . B-2
Figure B-2. 1999 NOx Point Source Emissions B-2
Figure B-2. 1999 NOx Point Source Emissions B-2

Appendix C - Meteorological Information

Figure C-1. KCI Airport Wind Rose (Jan. - Dec., 2000-2002) C-1
Figure C-2. KCI Airport Ozone Season Wind Rose (Apr. 1 - Oct 31., 2000-2002) C-2
Figure C-3. KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2000 . . . C-3
Figure C-4. KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2001 . . . C-4
Figure C-5. KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2002 . . . C-5
Figure C-6. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2000 . . . . . C-6
Figure C-7. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2001 . . . . . C-7
Figure C-8. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2002 . . . . . C-8
Figure C-9. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2000 . . . . . C-9
Figure C-10. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2001 . . . . . C-10
Figure C-11. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2002 . . . . . C-11
Figure C-12. Olathe Executive Airport Ozone Season Wind Rose (Apr. 1 - Oct 31., 2000-2002) C-12

Figure C-13. Lawrence Airport Ozone Season Wind Rose (Apr. 1 - Oct 31., 2000-2002) C-13
Figure C-14. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2000-2002 . . . . . C-14
Table C-1. Summary of Meteorological Conditions on 8-Hour Ozone Exceedance Days, 2000-2002 . . . . . C-15

Appendix D - Population and Growth
Table D-1. Summary of Population Data by County D-1
Table D-2. Summary of Population, Employment, and Average Daily Vehicle Miles Traveled (ADVMT) in Kansas City Area Counties D-2
Figure D-1. 2000 Population by County D-3
Figure D-2. 2000 Population Density by Census Tract D-4
Figure D-3. Population Growth by County D-5

Appendix E - Transportation
Figure E-1. 1999 Average Daily Vehicle Miles Traveled by County E-1
Table E-1. Commute Patterns in the Kansas City Region E-2

Appendix F - Topography & Geography
Figure F-3. Topography of Kansas City Area and Locations of Ozone Monitoring Sites F-1

Appendix G - Other Supporting Materials
Letter From the Mid-America Regional Council (MARC) Board of Directors G-1

INTRODUCTION/BACKGROUND

The Bureau of Air and Radiation of the Kansas Department of Health and Environment (KDHE) prepared this document to inform and support the recommendation from the Governor of the State of Kansas to the U.S. Environmental Protection Agency (EPA) for designating the Kansas portion of the Kansas City area as nonattainment under the 8-hour ozone National Ambient Air Quality Standard (NAAQS). This document outlines the criteria against which each county in the Kansas City area was evaluated and presents the data and technical analysis that form the basis of the recommendation. The State of Missouri Department of Natural Resources is concurrently working on a similar package regarding the designation of the Missouri counties of the Kansas City area.

The Governor's recommendation for the boundary of the Kansas City 8-hour ozone nonattainment area is due to the EPA by July 15, 2003. The EPA is required to promulgate its designations by April 15, 2004. The EPA is not bound by the recommendation, which simply provides the opportunity for the States to have input into the process, and to recommend changes from the presumptive boundaries established by the EPA.

Clean Air Act Requirements

The Clean Air Act, as amended, requires the EPA to designate air quality control regions as either attainment, nonattainment, or unclassified "upon the promulgation or revision of a NAAQS."[1] These classifications are based on air quality monitoring data that indicate: an area meets the NAAQS for a given pollutant; does not meet the NAAQS; contributes to an area which does not meet the NAAQS; or there is insufficient data to indicate whether it does or does not meet the NAAQS. The adoption of the 8-hour ozone standard in 1997 triggered the requirement to make such a designation.[2]

The 8-Hour Ozone Standard

The 8-hour ozone standard is 0.080 parts per million (ppm) measured over an 8-hour time period. Compliance with the standard is determined based on comparing the 3-year average of the annual 4th-highest daily maximum 8-hour ozone concentration to the standard. Due to the rounding convention, 3-year, 4th-highest ozone concentrations less than 0.085 ppm are considered to be below the standard, and values equal to or greater than 0.085 ppm are considered to be in violation of the standard.

---

[1] 42 U.S.C. §7407(d)(1)(B)(i)

[2] See, 42 U.S.C. §7407(d)

The Kansas City Situation

Current Status

The Kansas City area, consisting of Johnson and Wyandotte Counties in Kansas and Clay, Jackson and Platte Counties in Missouri, was in violation of the 1-hour ozone standard throughout the 1980's. Efforts to control emissions of volatile organic compounds (VOCs) in the five-county area resulted in the area achieving attainment status in the early 1990's. EPA formalized Kansas City's attainment status by designating the five-county area a maintenance area in 1992.[3] (Figure 1 shows the boundary of the Kansas City maintenance area.) As a part of this redesignation process, the region was required to develop a Maintenance Plan, which committed the region to ensure that its clean air status under the 1-hour ozone standard would be maintained. Based on the most recent monitoring data (2000 through 2002), the Kansas City area is in attainment of the 1-hour ozone standard.

Since the promulgation of the 8-hour ozone NAAQS in 1997, the KDHE has monitored the Kansas City region's air quality under this more stringent standard. Based on 2000 - 2002 monitoring data, the region's 8-hour ozone design value is 0.085 ppm, which exceeds the 8-hour ozone standard.

Chronological History

The five-county Kansas City region was determined to be in violation of the ozone NAAQS in 1978.[4] Subsequently, the state of Kansas developed and implemented an Ozone SIP for the Kansas side of the region. EPA approved the 1979 Kansas SIP revision, which projected that the Kansas City area would meet the ozone NAAQS by December 31, 1982. In calendar years 1983 and 1984, the ambient air monitoring data for the region revealed that violations to the ozone NAAQS had occurred. These violations required the state to make revisions to the 1979 SIP.

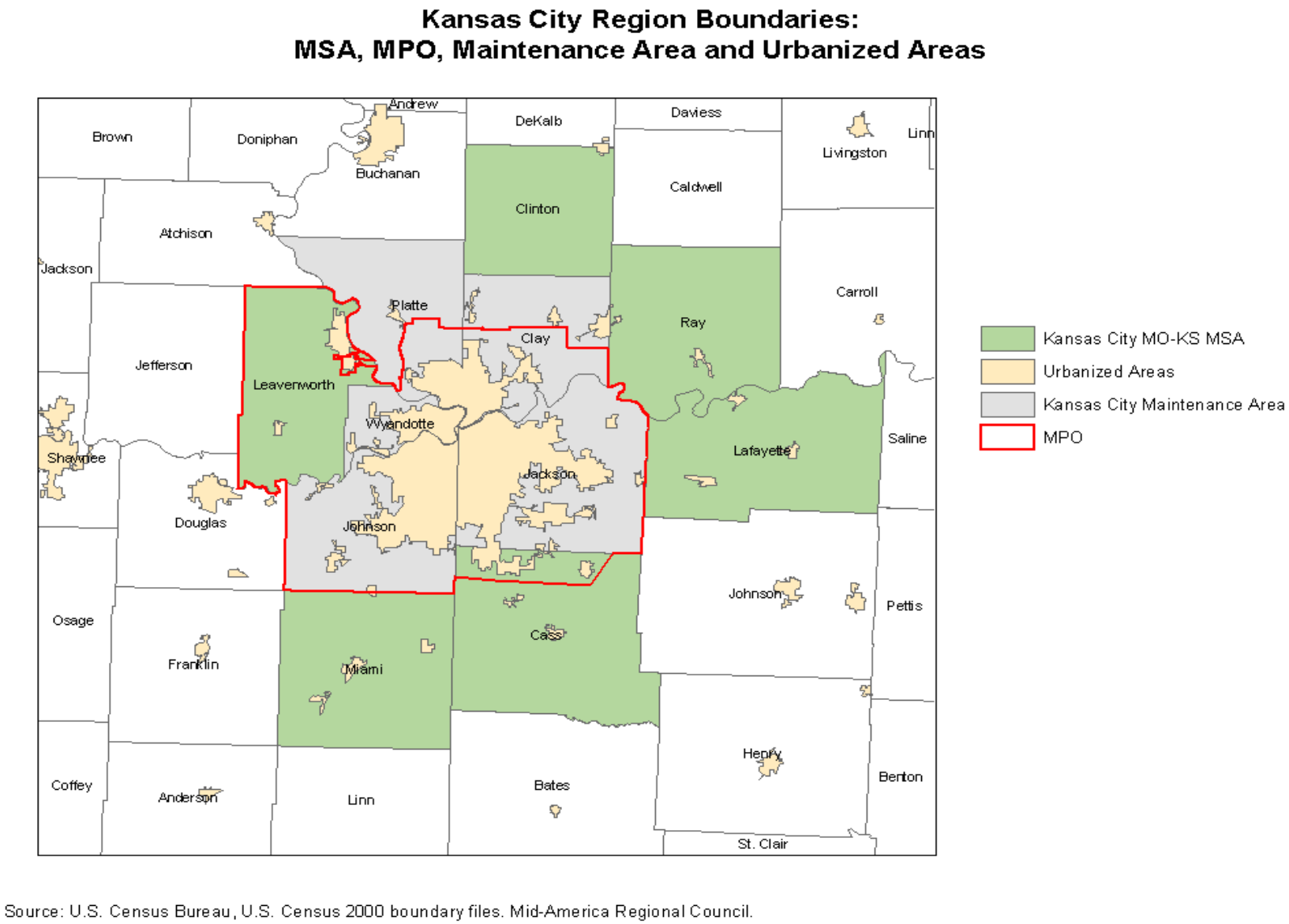
Accordingly, the SIP was revised to include additional control measures for the region. With further reductions of VOC emissions in the area, the new SIP projected the area would be in attainment of the ozone NAAQS by December 31, 1987. In November 1989, the SIP was fully approved by the EPA. At the end of 1991, sufficient monitoring data was available to demonstrate that the area had attained the standard. The KDHE revised the Kansas Ozone Maintenance Plan portion of the SIP to reflect that the region had achieved the ozone standard. This Maintenance Plan was approved by EPA in June 23, 1992.

During the summer of 1995, the Kansas City area recorded its fourth exceedance for the period 1993-1995, resulting in a violation of the ozone standard at the Liberty, Missouri monitoring site for the three-year period. The recorded violation required KDHE to implement contingency measures. After much discussion of contingency measures in the SIP and the potential to implement alternative measures achieving similar reductions, the state implemented a low-RVP gasoline regulation in 1997.

---

[3] 57 *Federal Register* 27936, June 23, 1992

[4] 43 *Federal Register* 8962, March 3, 1978



Source: U.S. Census Bureau, U.S. Census 2000 boundary files. Mid-America Regional Council.

Figure 2 - Kansas City Metropolitan Area Boundaries

EPA determined that the VOC reductions realized by the 7.2 RVP gasoline and other control measures implemented by the states were insufficient to meet the VOC reductions required to be equivalent to the contingency measures of the maintenance plan (64 FR 3896, January 26, 1999, Appendix D). On July 7, 2000, the governor of Kansas committed to implement a 7.0 psi RVP fuel program in Johnson and Wyandotte counties with a target date of the summer of 2001. The state also committed to implementation of a phased program to reduce the vapor pressure of cold cleaning solvents to less than or equal to 1.0 mmHg. Both commitments were fulfilled. The Bureau revised the Kansas City Maintenance Plan in December 2002.

Eight-Hour Ozone NAAQS Area Designation Process

KDHE BAR Staff Analysis

EPA's March 28, 2000 memorandum, "Boundary Guidance on Air Quality Designations for the 8-Hour Ozone National Ambient Air Quality Standards," provides guidance to States and Tribes on determining nonattainment area boundaries. The guidance establishes the Metropolitan Statistical Area or Consolidated Metropolitan Statistical Area (C/MSA) as the presumptive boundary for 8-hour ozone nonattainment areas. In addition, the guidance identifies eleven criteria for States and Tribes to consider in determining whether to recommend nonattainment area boundaries that are larger or smaller than the C/MSA. The criteria are as follows:

1. Emissions 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 areas and larger areas (urban or regional scale);
4. Location of emission sources (emission sources and nearby receptors should generally be included in the 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; and
11. Regional emission reductions (*e.g.*, NOx SIP call or other enforceable regional strategies).

The counties in the Kansas City MSA plus Douglas County were evaluated within this framework. The Kansas City MSA includes Johnson, Leavenworth, Miami and Wyandotte Counties in Kansas and Cass, Clay, Clinton, Jackson, Lafayette, Platte and Ray Counties in Missouri. (See Figure 1.) Although not part of the Kansas City MSA, Douglas County was evaluated because it is of interest to EPA Region 7

staff. Linn County is addressed briefly as well due to concerns about emissions from the LaCygne power plant. Department staff determined that the eleven criteria fit into four fundamental groupings. The primary emphasis is placed on the actual air quality components–air quality monitoring data, meteorology and emissions. The secondary grouping focuses on the effects of population and transportation, including growth in those elements. The third grouping consists of geography; jurisdiction; emissions controls; and regional emissions reduction strategies.

Section 2 of this document presents the data and analysis for each county. The counties on the Kansas side of the MSA are presented first, followed by the counties on the Missouri side of the MSA and finally by Douglas and Linn Counties. Each county's analysis is organized into sections based on EPA's criteria. The air quality sections address air quality and ozone monitoring data from the most recent three-year period (2000 - 2002) in each county and in adjacent areas. The emissions sections discuss emissions of nitrogen oxides (NOx) and volatile organic compounds (VOCs), locations of sources and emissions growth. The meteorological conditions sections address meteorological data and transport patterns. The population sections address population and expected population growth, and the transportation sections discuss traffic and commuting patterns and expected growth in vehicle miles traveled. The remaining sections address the geography/topography, jurisdictional boundaries, level of control of emissions and regional emission reductions criteria. For each of the Kansas counties, a summary and recommendation are presented. The counties on the Missouri side were evaluated for comparative purposes only and therefore no summaries or recommendations are presented for these counties.

Coordination with Other Agencies

The KDHE Bureau of Air and Radiation staff established a process for development of this support document that included significant consultation with the local officials, the State of Missouri Department of Natural Resources (MDNR), EPA Region 7 and the Mid-America Regional Council (MARC), which also served as a coordinator in getting the stakeholders together.

Through the MARC Air Quality Forum, a technical workgroup was formed to evaluate the data which would be the basis for the recommendation. The group included staff from KDHE, MDNR, county officials, and was facilitated by the MARC staff. Staff from EPA also observed, and found the process instructive. The workgroup met twice and held a conference call to discuss the issues involved. The process resulted in a memorandum which presented its recommendation to the AQF, and the salient data which supported the recommendations. The AQF subsequently considered and voted to submit the memorandum to the MARC Board of Directors. The Board has approved and submitted their letter endorsing the recommendation. Their recommendation is included in Appendix G.

Continuing Commitment to Assure Regional Air Quality

The State will continue to evaluate the air quality in the counties not designated as nonattainment, and, in the event that the data indicates that such counties are not in attainment, the State will work with the EPA and KCMA partners to take appropriate actions, including, if appropriate, redesignation to nonattainment.

METEOROLOGY OF OZONE FORMATION IN KANSAS CITY

Weather patterns play a significant role in establishing conditions conducive to ozone formation and accumulation, and in terminating episodes of high ozone concentrations. High ozone episodes are usually associated with slow-moving, high-pressure weather systems that traverse the central and eastern United States from west to east and from northwest to southeast. There are numerous reasons why these slow-moving, high-pressure systems promote high concentrations of ozone:

- High-pressure systems are characterized by widespread sinking of air through most of the lower atmosphere. The subsiding air is warmed adiabatically and thus tends to make the lower atmosphere more stable and less conducive to convective mixing. Adiabatic warming of the air occurs as the air compresses while sinking; no heat is added to it.
- The subsidence of air associated with large high-pressure systems creates an inversion of the normal temperature profile (normally temperature decreases with height in the lower atmosphere), which serves as a strong lid to contain pollutants in a shallow layer of the lower atmosphere. During an inversion, the temperature of the air in the lower troposphere increases with height, and the cooler air below does not mix with the warmer air above.
- Because winds associated with major high-pressure systems are generally light, there is a greater chance for pollutants to accumulate in the atmospheric boundary layer, the turbulent layer of air adjacent to the earth's surface.
- The often cloudless and warm conditions associated with large high-pressure systems also are favorable for the photochemical production of ozone.

In the Kansas City area, meteorology of ozone formation is fairly consistent with this analysis. The ozone season for Kansas City runs from April 1st to October 31st. During this time, surface conditions over much of the central United States are dominated by small-scale shifts in a large upper air high-pressure system located over the western Atlantic Ocean. This large high-pressure system, called the Bermuda High, brings light southerly winds and moisture from the Gulf of Mexico to the Kansas City area. This moisture often leads to the hazy conditions experienced in the region during the summer months.

Previous experience has indicated that elevated 1-hour ozone concentrations would only occur under ideal conditions with daytime temperatures greater than 85 degrees Fahrenheit, clear skies and surface wind speeds less than 10 miles per hour. In contrast, it is important to note that the 8-hour exceedance threshold is lower than that of the 1-hour ozone standard. Because of this, a broader range of meteorological conditions can cause ozone concentrations in excess of 0.084 parts per million. In fact, there are indications in the Kansas City area that would suggest that less severe meteorological conditions could lead to ozone exceedances under the new standard. Several synoptic weather patterns seem to be prevalent during 8-hour ozone episodes in Kansas City. The following scenarios describe the two most prevalent weather patterns that contribute to high ozone in the area:

- Surface high-pressure area located over the New England States during the beginning of the episode slowly moves southward toward the Mid-Atlantic States and then drifts out to sea. A frontal boundary located over the upper Midwest slowly progresses southward to the Iowa-Missouri border before becoming nearly stationary.
- A large area of high pressure is located over the Mid-Atlantic States and the four corners region of the Desert Southwest. A weak front located along the Kansas-Nebraska border remains nearly stationary but may occasionally meander across the Kansas City metropolitan area.

Table C-1 (Appendix C) lists the 8-hour exceedance days in Kansas City for the years 2000-2002, along with relevant meteorological data for each of those days. It is worth noting that although all the criteria mentioned above for 1-hour exceedance days were met, the average wind speed category is especially interesting. Although the average wind speed for all exceedance days over this three-year period remained below 10 miles per hour, there were numerous exceedance days that were pushing the 10 miles per hour benchmark. In fact, there were several days in which monitors in the Kansas City area exceeded the 8-hour ozone standard with winds greater than 10 miles per hour.

Wind roses from the Kansas City International Airport (KCI) during 2000, 2001 and 2002 are provided in Figures C-1, C-2, C-3, C-4 and C-5. Figure C-1 shows wind conditions for the entire three-year period, all hours of the day. This figure shows the strong southerly wind component exhibited over this period and especially with winds from the due south. Figure C-2 gives the wind rose over this same three-year period but only shows winds during the ozone season (April 1st - October 31st). Once again, a strong southerly component is shown across the Kansas City area with a slightly more pronounced south-southeasterly component. The next three figures (C-3, C-4 and C-5) show wind directions on 8-hour ozone exceedance days for the years 2000, 2001 and 2002, respectively. The roses only show the wind directions and speeds for the hours of 7:00 a.m. to 7:00 p.m. The wind roses for 2000 and 2001 continue to show the long-term trend associated with high ozone in Kansas City with a strong southerly wind component, especially from the due south. However, 2002 was a bit unique in that the predominant wind direction on ozone days was from the southeast. Almost 25% of the winds were from the southeast on high ozone days in 2002. Whether this trend continues or is a unique occurrence is yet to be seen in the future. When viewing all this information, the conclusion is that winds with a strong southerly component continue to be predominant on high ozone exceedance days in Kansas City.

In addition, forward and back trajectories have been developed from the NOAA-Hysplit trajectory model for all of the 8-hour exceedance days in Kansas City during 2000-2002. Understanding the limitations of the model's large grid cell makeup and thus its coarse wind field resolution, the Hysplit model can still be used to understand basic transport corridors and potential areas of ozone and ozone precursor originations. For the years 2000 and 2001 (Figures C-6 and C-7), the back trajectories show the historical source regions for air on high ozone days in Kansas City. The majority of these trajectories originated in Texas, Oklahoma and, to a lesser extent, Louisiana with flow into the Kansas City area from the south and southwest. Figure C-8 shows the trajectories from 2002. This graphic clearly shows the differences observed in the wind direction coming into the area on ozone days in 2002. Many of these

trajectories originated in Arkansas, Illinois, and a couple from Ohio and Indiana. This is clearly a different source region for Kansas City. Whether this pattern continues in 2003 or whether the pattern reverts back to the historical source regions is yet to be seen. With this information in mind, some nearby, upwind MSA's of interest are Springfield, MO.; Tulsa, OK.; and potentially, Wichita, KS. The Springfield MSA has a 1999-01 ozone design value of 73 ppb and 2000-2002 design value of 76 ppb. The Tulsa MSA has 1999-01 and 2000-02 design values of 90 ppb, while Wichita's 1999-01 and 2000-02 design values are 81 ppb. The forward trajectories (Figures C-9,C-10, and C-11) are used to illustrate potential transport corridors and areas that may be receiving ozone or ozone precursors from the Kansas City metropolitan area. The trajectories for 2000-2002 show that Iowa and Wisconsin are the two main areas that are potential downwind receptors of Kansas City air on high ozone days.

PRESENTATION OF COUNTY-BY-COUNTY DATA

Sources of Data

The emissions and boundary maps were generated from shapefiles of county boundaries, urbanized areas and MSAs from the U.S. Census Bureau. A shapefile of the MPO boundary was also obtained from MARC. The maps in Appendix A were prepared using Surfer Version 8 software. Surfer is a contouring, gridding and surface mapping software package. The maps show ozone concentrations in gradients of 0.05 ppm based on ozone monitoring results for the above three-year period. Results are from Kansas and all surrounding states.

Point source emissions for Kansas counties are from the KDHE Bureau of Air and Radiation point source emissions database for 1999. Missouri point source emissions are from the 1999 National Emissions Inventory (NEI), Final Version 2. Area source emissions for Kansas counties within the maintenance area were taken from the 1999 Kansas City Maintenance Area Inventory, which was done in support of the 2002 Maintenance Plan revision. Area source emissions for Kansas counties outside of the maintenance area are from the 1999 NEI, Final Version 2. Missouri area source emissions data are from the MDNR Air Pollution Control Program area source emissions database. Offroad mobile source emissions for all Kansas and Missouri counties are from the 1999 NEI, Final Version 2 and were developed using a 2002 draft of the NONROAD model called the "Lockdown C" version. Onroad mobile source emissions for all Kansas and Missouri counties are from the 1999 NEI Final Version 2 and were generated using the MOBILE6 model.

Point source emissions projections for the year 2012 for the Kansas and Missouri counties within the maintenance area are from the work done in support of the 2002 Kansas City Maintenance Plan revision. The projections were developed using the Department of Commerce's Bureau of Economic Analysis (BEA) growth factors from EPA's Economic Growth Analysis System (EGAS) version 4.0. Mobile source emissions projections for the counties within the maintenance area are from the work done in support of the 2002 Maintenance Plan update, which was based on the MOBILE6 model.

Year 2000 population information for all Kansas and Missouri counties is from the 2000 Census. TIGER files from the 2000 Census were also used for creating the map of 2000 population density by Census tract. Population projections through 2030 for counties within the MPO boundary are from the 2002 Kansas City Metropolitan Area Long Range Forecasts provided by the MARC Population projections for Kansas counties outside the MPO boundary are from *The Governor's Economic and Demographic Report, 2001-2002*, Kansas Division of the Budget, January 2002. 2000 employment figures are from County Business Patterns. Additional information on county growth patterns was provided by the MARC.

1999 average daily VMT data for counties within the maintenance area are from the Mid-America Regional Council. 1999 average daily VMT for Kansas counties outside the maintenance area are from the Kansas Department of Transportation, and 1999 average daily VMT for Missouri counties outside the maintenance area are from the Missouri Department of Transportation. Average daily VMT growth information for the Kansas and Missouri counties within the maintenance area is from the work done in support of the 2002 Kansas City maintenance plan revision. Douglas County also provided information on expected VMT growth in Douglas County.

County-to-county worker flow counts are from the U.S. Census Bureau, 2000 Census. The data were compiled by MARC.

General meteorological data for the Kansas City area reported in this document were obtained from the NOAA National Data Center (NNDC). Wind Roses were produced with WRplot View software developed by Lakes Environmental and meteorology data also obtained from the NNDC. The back and forward trajectories where produced using NOAA Air Resources Laboratory's HYSPLIT transport and dispersion model and code modification developed by Bret Anderson at EPA Region 7.

Where to Find the Data in This Document

Appendix A includes the air quality monitoring data. Table A-1 summarizes the 4th-highest 8-hour ozone values for each monitor for 2000 through 2002. Table A-2 summarizes 8-hour ozone exceedances from 2000 through 2002. Appendix A also includes the ozone concentration maps prepared using the Surfer software package.

Appendix B contains the emissions information. Table B-1 summarizes 1999 NOx and VOC emissions by source category type and county. Figures B-1 and B-3 graphically illustrate total county emissions of NOx and VOC, respectively. Figures B-2 and B-4 are maps showing the locations of the significant point sources of NOx and VOC, respectively. Tables B-2 and B-3 summarize 1999 NOx and VOC point source emissions by facility in Kansas and Missouri, respectively.

Appendix C contains the meteorological data. Figure C-1 shows a wind rose from Kansas City International Airport for the time period of 2000-2002, all hours of the day. Figure C-2 shows a wind rose from Kansas City International Airport for the same time period of 2000-2002, but includes only the ozone season (April 1st - October 31st) wind data. Figure C-3 shows a wind rose from Kansas City International Airport for 8-hour exceedance days in 2000. Figure C-4 shows a wind rose from Kansas City International Airport for 8-hour exceedance days in 2001. Figure C-5 shows a wind rose from Kansas City International Airport for 8-hour exceedance days in 2002. Figures C-6, C-7 and C-8 graphically illustrate 500m (meter) back trajectories from the Kansas City area on 8-hour ozone exceedance days during the years of 2000, 2001 and 2002, respectively. Figures C-9, C-10 and C-11 graphically illustrate 500m (meter) forward trajectories from the Kansas City area on 8-hour ozone exceedance days during the years of 2000, 2001 and 2002, respectively. Figure C-12 shows a wind rose

from the Olathe Executive Airport for the ozone season (April 1st - October 31st) during the years of 2000-2002. Figure C-13 shows a wind rose from the Lawrence Airport for the ozone season (April 1st - October 31st) during the years of 2000-2002. Figure C-14 illustrates 500m (meter) back trajectories from the Kansas City area on 8-hour ozone exceedance days during the years of 2000, 2001 and 2002. Table C-1 lists the 8-hour exceedance days in Kansas City for the years 2000-2002, along with relavant meteorological data for each of those days.

Appendix D includes the population data. Table D-1 summarizes population from the 1990 and 2000 censuses and population forecasts from 2010 through 2030. Table D-2 is a summary of 2000 population, 2000 employment and 1999 average daily VMT information. Figure D-1 is a bar chart of 2000 population by county, and Figure D-2 is a map of 2000 population density. Figure D-3 is a graph of population growth through 2030.

Appendix E contains the transportation data. Figure E-1 is a bar chart showing 1999 average daily VMT for each county. Table E-1 summarizes the numbers of round-trip work trips to and from the counties being considered.

Appendix F contains a topographical map of the Kansas City region. The map also shows the locations of the region's six ozone monitors.

Appendix G contains documents received from local governments and the Mid-America Regional Council of Governments.

Johnson County

Air Quality: There were no ozone monitors operating in Johnson County during the three-year period from 2000 to 2002. The closest monitoring sites to Johnson County are at Richards Gebaur South located in Cass County southeast of the Johnson County urban core and at the JFK Community Center in downtown Kansas City, Kansas. These two monitors show 8-hour design values of 0.079 ppm and 0.081 ppm respectively.

Emissions: Total Johnson County NOx emissions for 1999 were 24,523 tons. This represents 17% of the total NOx emissions for the MSA. Point source emissions were 1,484 tons of this total, with the bulk (1,344 tons) coming from the AFG glass manufacturing facility located in the southcentral part of the county, near the Miami County border. Projected growth of NOx point source emissions in Johnson County based on work performed for the 2002 SIP update is 8% from 1999 through 2012. Projected growth of point source emissions in the SIC category that includes glass production is 6%. Area source emissions were 10,360 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth (22% increase from 2000 through 2010). Mobile source NOx emissions were 12,679 tons. The county's mobile source NOx emissions are projected to decrease 48% from 1999 to 2012.

Total Johnson County VOC emissions for 1999 were 26,152 tons. This represents 25% of the total VOC emissions for the MSA. Point source emissions were 613 tons of this total, with only one facility having emissions marginally greater than

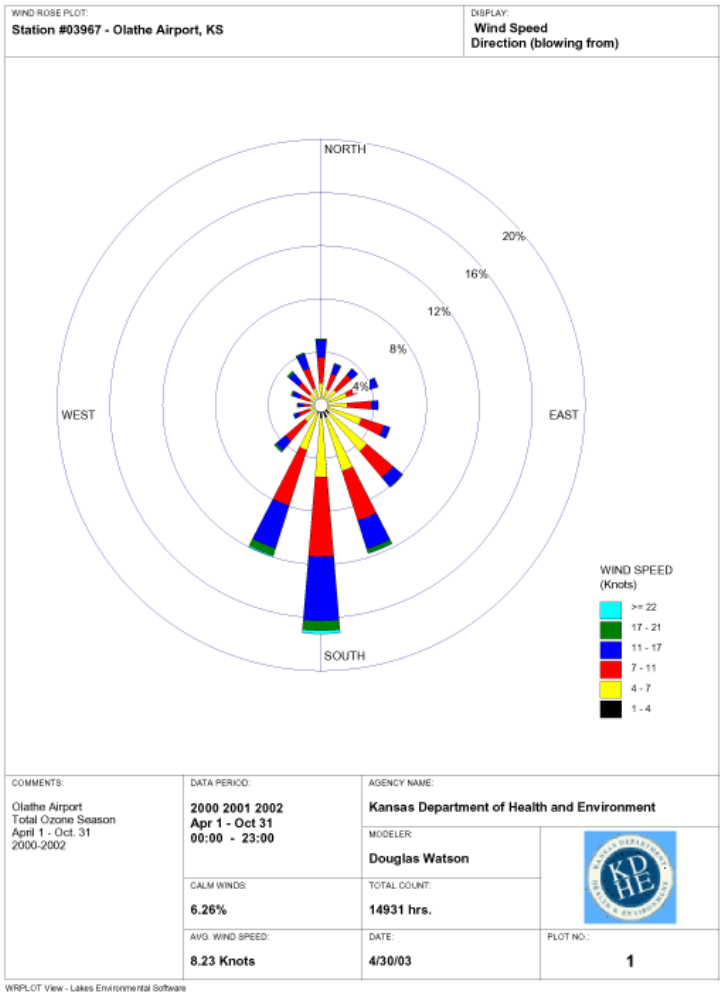


Figure 3

major source thresholds–the Robbie Manufacturing commercial printing facility (132 tons) located near the center of the county. Projected growth of VOC point source emissions in Johnson County based on work performed for the 2002 SIP update is 14% from 1999 through 2012. Projected growth of point source emissions in the SIC category that includes printing operations is 12%. Area source VOC emissions were 15,872 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth (22% increase from 2000 through 2010). Mobile source VOC emissions were 9,667 tons. The county's mobile source VOC emissions are projected to decrease 47% from 1999 to 2012.

Meteorological Conditions: Johnson County is located generally southwest of the Kansas City urban core and south-southwest of the monitors with the highest ozone concentrations (KCI, Liberty, and Rocky Creek). The Olathe Executive Airport (OJC) wind rose (Figure 2) representing the most current three years of ozone season data shows that emissions from Johnson County would be very likely to participate in ozone formation in the Kansas City area.

Olathe (OJC) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show minimal potential for Johnson County population being affected by short range transport of ozone from the Kansas City area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Johnson County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Johnson County in 2000 was 451,086, or 25% of the population of the MSA. Johnson County's population increased 27% from 1990 to 2000. The county's growth has occurred primarily to the west, along the K-10 and K-7 corridors, and to the south, along the I-35 corridor. The county population is projected to grow 22% from 2000 to 2010. The population density of Johnson County is 946 persons per square mile.

Transportation: Average daily VMT in 1999 for Johnson County was 13,289,730 miles, or 24% of the total average daily VMT for the MSA. The county's average daily VMT is projected to grow to 19,993,020 by 2012, a 50% increase from 1999 levels.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Johnson County, 31% leave the county, and 69% remain in the county. The commuters that leave the county primarily travel to Jackson and Wyandotte counties. Of the total number of work trips with Johnson County as a destination, 35% begin outside the county, and 65% originate within Johnson County. Of those trips originating outside of the county, most start in Jackson and Wyandotte counties. Overall, the commuters residing in Johnson County contribute about 28% of

the work trips originating in the MSA, and the county receives about 29% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	165,924
Leavenworth (KS)	847
Miami (KS)	564
Wyandotte (KS)	14,791
Douglas (KS)	1,462
Cass (MO)	587
Clinton (MO)	0
Clay (MO)	3,766
Jackson (MO)	49,687
Lafayette (MO)	33
Platte (MO)	1,984
Ray (MO)	13
Total	**239,658**

From where do the county's commuters come?

Johnson (KS)	165,924
Leavenworth (KS)	3,560
Miami (KS)	5,950
Wyandotte (KS)	18,996
Douglas (KS)	5,578
Cass (MO)	6,686
Clinton (MO)	146
Clay (MO)	5,938
Jackson (MO)	39,018
Lafayette (MO)	341
Platte (MO)	3,304
Ray (MO)	161
Total	**255,602**

Geography/topography: Much of Johnson County consists of gently rolling uplands with hilly areas along the streams. The flood plain along the Kansas River ranges from 1 to 2 miles in width. The highest point in the county, about 1,134 feet above mean sea level, is in the southeastern part; and the lowest point, about 742 feet, is along the Kansas River where the river flows eastward into Wyandotte County. Maximum relief in the county is about 392 feet. The area of Johnson County is 477 square miles. The Kansas River flood plain, located on the northern border of Johnson County has the potential to provide a preferential pathway for ozone precursors and ozone both in and out of the Kansas City metro area. Prevailing winds during the ozone season indicate that such localized transport is more likely to occur into the Kansas City area. The topography of the balance of Johnson County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Johnson County is located within the Kansas City Metropolitan Statistical Area. It is part of the current 1-hour ozone maintenance area. It is within the Kansas City Metropolitan Planning Organization boundary.

Level of control of emission sources: Emissions sources in Johnson County are subject to the Kansas Air Quality Regulations generally, which include the state regulations adopting the NSPS, NESHAP, and the MACT standards. In addition, the state has adopted Reasonably Available Control Technology

(RACT) rules to control sources of VOCs within the existing nonattainment area counties. These rules are contained in K.A.R. 28-19-61 through 77, and 28-19-714. They address the following sources of VOC emissions: surface coating; gasoline loading terminals; gasoline service stations - stage I; petroleum storage tanks; refinery sources; cutback asphalt; solvent metal cleaning; printing; gasoline tank truck leaks; fiberglass manufacturing; detergent and chemical processing facilities; commercial bakeries; and solvent metal cleaning. An additional VOC control measure is the low-volatility fuel regulation, K.A.R. 28-19-719, which restricts the volatility of motor vehicle fuel during the ozone season in Johnson and Wyandotte Counties.

New and modified sources, prior to construction of a source in the Kansas City Maintenance Area must meet the applicable BACT requirements if subject to the PSD program, or for minor sources, the appropriate levels, which may be RACT

Regional emissions reductions: The State of Kansas has not adopted any regional or statewide NOx or VOC control regulations more stringent than those contained in the federal air program.

Summary: Johnson County is located south of the urban core of the MSA. Meteorological conditions support strong contribution to ozone formation in the MSA It has the second largest NOx and VOC emissions; the second largest population; the third greatest population density; and the second largest ADVMT in the MSA Significant population and employment growth is expected.. There are no criteria that do not support including Johnson County in the 8-hour designation area.

Recommendation: It is recommended that Johnson County be included in the area designated as nonattainment for the 8-hour ozone standard for the Kansas City area.

Leavenworth County

Air Quality: There were no ozone monitors operating in Leavenworth County during the three-year period being evaluated for this designation process. The closest monitoring sites to Leavenworth County are at KCI airport in south-central Platte County, the JFK Community Center in downtown Kansas City, Kansas and the KU Field Station in the southeast corner of Jefferson County approximately two miles from the southwest corner of Leavenworth County. Design values for the first two sites are 0.084 ppm, and 0.081 ppm respectively. The 4th high 8-hour value for the KU Field Station monitor was 0.082 ppm. The highest 8-hour average ozone value measured was 0.084 ppm. KDHE has installed a reference method ozone monitor in the northern area of the City of Leavenworth. This monitor will provide data for the ozone season of 2003 which will be useful for the final designation.

Emissions: Total Leavenworth County NOx emissions for 1999 were 3,328 tons. This represents 2% of the total NOx emissions for the MSA. Point source emissions were 59 tons. Area source emissions were 1,178 tons. Projected growth of area source emissions can be assumed to correspond closely to projected population growth (9% increase from 2000 through 2010). Mobile source NOx emissions were 2,091 tons. No information regarding mobile source NOx emissions growth is available.

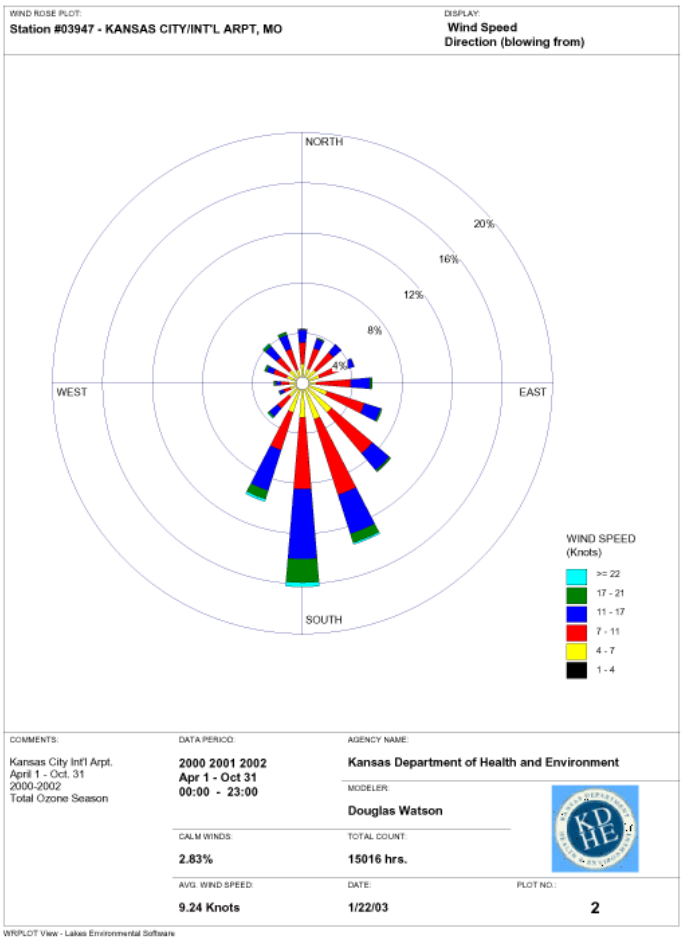


Figure 4

Total Leavenworth County VOC emissions for 1999 were 3,482 tons. This represents 3% of the total VOC emissions for the MSA. Point source emissions were 273 tons. The bulk of these emissions (228 tons) were from one large printer (Hallmark) located in the northeast area of the county in the City of Leavenworth Area source emissions were 1,917 tons. Projected growth of area source emissions can be assumed to correspond closely to projected population growth (9% increase from 2000 through 2010). Mobile source VOC emissions were 1,291 tons. No information regarding mobile source VOC emissions growth is available.

Meteorological Conditions: Leavenworth County is located west of the Kansas City urban core and west-southwest of the monitors in Clay County. Most of the county point sources are located generally west and west-southwest of the Clay County monitors. The Kansas City International Airport (MCI) wind rose (Figure 3) representing the most current three years of ozone season data shows that emissions from Leavenworth County would be unlikely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast, and show some potential for Leavenworth County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Leavenworth County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Leavenworth County in 2000 was 68,691, or 4% of the population of the MSA. Leavenworth County's population increased 7% from 1990 to 2000. The county's growth has occurred primarily in the existing urban areas of Leavenworth, Basehor, and Tonganoxie, as well as along the transportation corridors of I-70 and Hwy. 7. The county population is projected to grow by 9% from 2000 to 2010. The population density of Leavenworth is 148 persons per square mile.

Transportation: Average daily VMT in 1999 for Leavenworth County was 1,409,053 miles, or 3% of the total average daily VMT for the MSA. No information regarding expected VMT growth in the county is available.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Leavenworth county, 37% leave the county, and 63% remain in the county. The commuters that leave the county primarily travel to Johnson and Wyandotte counties. Of the total number of work trips with Leavenworth County as a destination, 15% begin outside the county, and 85% originate within Leavenworth County. Of those trips originating outside the county, most start in Johnson, Platte and Wyandotte counties. Overall, the commuters residing in Leavenworth County contribute about 4% of the work trips originating in the MSA, and the county receives about 3% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	3,560
Leavenworth (KS)	19,105
Miami (KS)	25
Wyandotte (KS)	3,793
Douglas (KS)	785
Cass (MO)	72
Clinton (MO)	0
Clay (MO)	351
Jackson (MO)	1,701
Lafayette (MO)	7
Platte (MO)	712
Ray (MO)	0
Total	**30,111**

From where do the county's commuters come?

Johnson (KS)	847
Leavenworth (KS)	19,105
Miami (KS)	14
Wyandotte (KS)	612
Douglas (KS)	509
Cass (MO)	10
Clinton (MO)	17
Clay (MO)	229
Jackson (MO)	259
Lafayette (MO)	5
Platte (MO)	793
Ray (MO)	2
Total	**22,402**

Geography/topography: The main topographic features of Leavenworth County are the valleys of the Kansas and Missouri Rivers and their tributaries. The Missouri River Valley, 2 to 3 miles wide, is along the eastern and northern boundaries of the county. The Kansas River Valley, slightly more than 1 mile wide, is along the southern boundary. The lowest points in Leavenworth County are about 770 feet above sea level on the Missouri River flood plain at Leavenworth and about 790 feet on the Kansas River flood plain at Loring. The highest point is about 1,100 feet on the uplands above the Oread escarpment. The area of Leavenworth County is 463 square miles. The Kansas River and Missouri River flood plains have the potential to provide preferential pathways for ozone precursors and ozone both in and out of the Kansas City metro area. The Kansas River is located on the southern border of Leavenworth County. Prevailing winds during the ozone season indicates that such localized transport is more likely to occur into the Kansas City area along the Kansas River. The Missouri River flood plain is located on the eastern border of Leavenworth County. Prevailing winds during the ozone season indicate that such localized transport along the Missouri River is more likely to occur from the Kansas City core toward Leavenworth County. The topography of the balance of Leavenworth County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Leavenworth County is part of the Kansas City MSA
It is not part of the current 1-hour ozone maintenance area. The bulk of the county is within the Kansas City MPO boundary.

Level of control of emissions: The emissions sources in Leavenworth County are subject to state SIP rules and federal rules of general applicability, such as NSPS, NESHAPS, MACT and PSD.

Regional emission reductions: The emission sources in Leavenworth County are not subject to the NOx SIP call or other enforceable regional strategies.

Summary: Leavenworth County is primarily a rural county located northwest of the Kansas City urban core. Population and emissions sources are concentrated in the northeast corner of the county, directly west of the monitors in Platte and Clay counties in Missouri that have recorded violations of the 8-hour ozone standard. The majority of meteorological regimes associated with high ozone concentrations in the Kansas City area would not support contribution by precursor emissions from Leavenworth County. Occasional conditions could result in a moderate area-wide contribution of Leavenworth County precursor emissions. Leavenworth County has the eighth largest VOC emissions; the ninth largest NOx emissions; the seventh largest population; the sixth greatest population density; and the eighth largest average daily vehicle miles traveled in the MSA. Leavenworth County is located in the MSA.

There were no ozone monitors operating in Leavenworth County during the three year period from 2000 to 2002. Preliminary conclusions regarding ozone concentrations in Leavenworth County can be drawn by reviewing ozone concentration maps prepared using the Surfer software package. Map A-1 shows the gradients for Kansas and surrounding areas. Map A-2 shows the gradients for northeast Kansas. Map A-2 shows ozone concentrations in Leavenworth County for the three-year period ranging from 0.077 to 0.081 with the higher concentrations in the northeast portion of the county.

Though modeling conducted by EPA for the NOx SIP call suggests that the 4th daily maximum 8-hour average in Leavenworth County would have exceeded the 8-hour standard based upon model inputs simulating June/July/August, 1995 episodes, monitoring data from that period indicates the model skewed the high ozone predictions to the west. The large grid cells used in the modeling extended over jurisdictional boundaries, resulting in entire counties being labeled with a modeled ozone concentration though only a small portion of the county may have been within the grid cell. With no monitoring data demonstrating a violation in Leavenworth County; with projected ozone concentrations well below the the 8-hour ozone standard; with historical data demonstrating the highest readings normally occur over central Clay County; and with prevailing wind directions during the ozone season taken into account, ozone levels in Leavenworth County can not be established in violation of the remanded 8-hour ozone standard.

Recommendation. It is recommended that Leavenworth County be excluded from the area designated nonattainment in and around Kansas City for the 8-hour ozone standard. There is no evidence that controlling ozone precursor emissions, either current or projected, in Leavenworth County will contribute to the goal of attaining the 8-hour standard in Kansas City. There is no evidence that Leavenworth County residents are exposed to ozone concentrations exceeding the 8-hour ozone standard for ozone.

Miami County

Air Quality: There are no ozone monitors located in Miami County. Evaluation of monitoring data from Mine Creek (located one county south of Miami) and Richards Gebaur (an upwind site on the Missouri side east of Miami County) show 8-hour design values of 0.073 ppm and 0.079 ppm respectively.

Emissions: Total Miami County NOx emissions for 1999 were 6,154 tons. This represents 4% of the total NOx emissions for the MSA. Point source emissions were 2,012 tons of this total, with over 99% of these emissions coming from one large- and two moderate-sized natural gas compressor stations located in the east-central and central parts of the county. Area source emissions were 3,164 tons. Projected growth of area source NOx emissions can be assumed to correspond to projected population growth, which is an increase of 16% from 2000 to 2010. Mobile source NOx emissions were 978 tons. No information regarding point or mobile source NOx emissions growth in the county is available.

Total Miami County VOC emissions for 1999 were 1,715 tons. This represents 2% of the total VOC emissions for the MSA. Point sources were 142 tons of this total, with none of the facilities having emissions greater than the major source threshold. Area source emissions were 1,057 tons. Projected growth of area source VOC emissions can be assumed to correspond to projected population growth, which is an increase of 16% from 2000 to 2010. Mobile source emissions were 516 tons. No information regarding point or mobile source VOC emissions growth in the county is available.

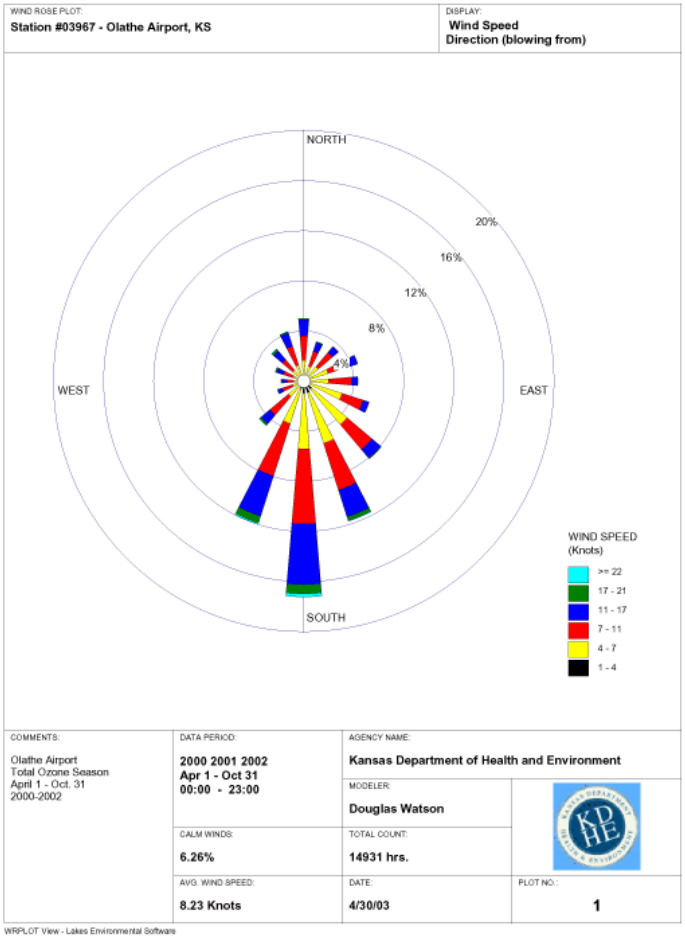


Figure 5

Meteorological Conditions: Miami County is located generally south-southwest of the Kansas City urban core and south-southwest of the monitors with the highest design values (KCI, and Liberty; Rocky Creek is too new to have established a design value). The Olathe Executive Airport (OJC) wind rose

(Figure 4) representing the most current three years of ozone season data shows that emissions from Miami County would potentially participate in ozone formation in the Kansas City area.

Olathe (OJC) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show minimal potential for Miami County population being affected by short range transport of ozone from the Kansas City area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Miami County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Miami County in 2000 was 28,351, or 2% of the population of the MSA. Miami County's population increased 21% from 1990 to 2000. The county's growth has occurred primarily in the urban areas of Paola, Osawatomie and Louisburg. Other areas for potential development include the 169 and 69 highway corridors. The county population is projected to grow 16% from 2000 to 2010. The population density of Miami County is 49 persons per square mile.

Transportation: Average daily VMT in 1999 for Miami County was 1,015,673 miles, or 2% of the total average daily VMT for the MSA. No information regarding expected VMT growth in the county is available.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Miami County, 56% leave the county, and 44% remain in the county. The commuters that leave the county primarily travel to Johnson County. Of the total number of work trips with Miami County as a destination, 15% begin outside the county, and 85% originate within Miami county. Of those trips originating outside the county, most start in Johnson County. Overall, the commuters residing in Miami County contribute about 2% of the work trips originating in the MSA, and the county receives about 1% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	5,950
Leavenworth (KS)	14
Miami (KS)	5,930
Wyandotte (KS)	427
Douglas (KS)	120
Cass (MO)	94
Clinton (MO)	0
Clay (MO)	70
Jackson (MO)	934
Lafayette (MO)	7
Platte (MO)	31
Ray (MO)	0
Total	**13,577**

From where do the county's commuters come?

Johnson (KS)	564
Leavenworth (KS)	25
Miami (KS)	5,930
Wyandotte (KS)	63
Douglas (KS)	58
Cass (MO)	224
Clinton (MO)	0
Clay (MO)	8
Jackson (MO)	80
Lafayette (MO)	7
Platte (MO)	10
Ray (MO)	0
Total	**6,969**

Geography/topography: The major topographic features in Miami County are the southeast-trending Marais des Cygnes River valley and the gently sloping upland plains formed by erosion of the flat-lying sedimentary rocks underlying the county. The highest point in the county, which is about 1,150 feet above mean sea level, is southeast of Louisburg. The lowest point, which is about 790 feet above mean sea level, is along the Marais des Cygnes River at the south edge of the county. Miami County has an area of 577 square miles. The topography of Miami County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Miami County is part of the Kansas City MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City MPO boundary.

Level of control of emissions: The emissions sources in Miami County are subject to state SIP rules and federal rules of general applicability, such as NSPS, NESHAPS, MACT and PSD.

Regional emission reductions: The emission sources in Miami County are not subject to the NOx SIP call or other enforceable regional strategies.

Summary: Miami County is a rural county located directly south of the existing five-county nonattainment area. Meteorological conditions during the ozone season support significant contribution of Miami County precursor emissions to ozone formation in the MSA. Miami County has the eleventh largest VOC emissions; the sixth largest NOx emissions; the ninth largest population; the ninth greatest population density; and the ninth largest ADVMT in the MSA. The county has one point source with substantial NOx emissions (1,725 tons/year). Miami County NOx and VOC emissions represent a very

small proportion of the total emissions for the MSA. Miami County is located in the MSA but not the current 1-hour maintenance area.

Preliminary conclusions regarding ozone concentrations in Miami County can be drawn by reviewing ozone concentration maps prepared using the Surfer software package. Map A-1 shows the gradients for Kansas and surrounding areas. Map A-2 shows the gradients for northeast Kansas. Map A-2 map shows ozone concentrations in Miami County for the three-year period ranging from 0.076 to 0.078 ppm with the higher concentrations in the northeast portion of the county. The prevailing weather pattern during the ozone season supports the conclusions drawn from the monitoring data for nearby areas.

Recommendation. It is recommended that Miami County be excluded from the area designated nonattainment for the 8-hour standard for the Kansas City area. There is not sufficient evidence that reducing anthropogenic VOC and NOx emissions in Miami County would significantly affect ozone formation in those areas of the Kansas City region which have recorded violations of the remanded 8-hour ozone standard. There is no evidence that Miami County residents are exposed to ozone concentrations exceeding the 8-hour ozone standard.

Wyandotte County

Air Quality: There is one ozone monitor located in Wyandotte County at the JFK Community Center in downtown Kansas City, Kansas. Evaluation of monitoring data from the JFK site show the 8-hour design value of 0.081 ppm. Based on this data, and historical trend data, Wyandotte County ozone concentrations are expected to sometimes exceed the NAAQS but not to violate the standard.

Emissions: Total Wyandotte County NOx emissions for 1999 were 16,367 tons, representing 11% of the total NOx emissions for the MSA. Point sources contributed 7,544 tons of this total, with the bulk (6,621 tons) emitted by two Board of Public Utilities power plants–the Nearman and Quindaro facilities, both located in the northeastern corner of the county. Projected growth of NOx point source emissions is 24% from 1999 to 2012. Projected growth of NOx emissions in the SIC category that includes electricity generation is 25%. Area source NOx emissions were 3,675 tons. Projected area source NOx emissions can be assumed to correspond to the projected change in population, which is a decrease of 0.3% from 2000 to 2010. Mobile source NOx emissions were 5,149 tons. The county's mobile source NOx emissions are projected to decrease 51% from 1999 to 2012.

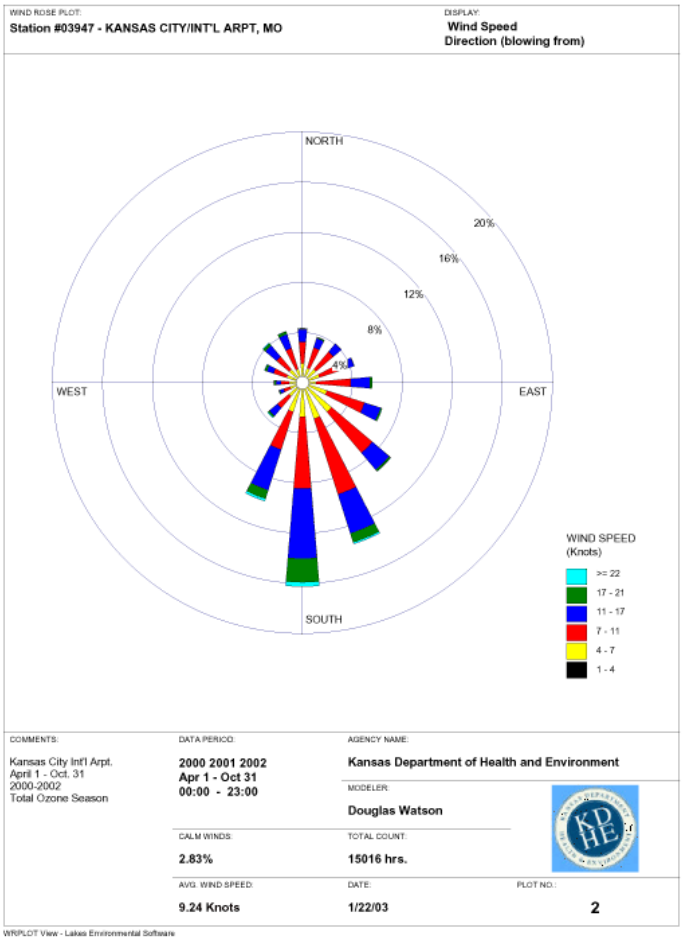


Figure 6

Total Wyandotte County VOC emissions for 1999 were 11,688 tons, which represents 11% of the total VOC emissions for the MSA. Point sources were 2,801 tons of this total. Approximately 48% (1,333 tons) of the point source VOC emissions came from the General Motors automobile manufacturing facility located in the northeastern corner of the county. Projected growth of VOC point source emissions is 22% from 1999 to 2012. Within the transportation equipment source category, projected growth of VOC emissions is 27%. Area source emissions were 4,752 tons. Projected area source VOC emissions can be assumed to correspond to the projected change in population, which is a decrease of 0.3% from 2000 to 2010. Mobile source emissions were 4,134 tons. The county's mobile source VOC emissions are

projected to decrease 50% from 1999 to 2012.

Meteorological Conditions: Wyandotte County is located generally west of the Kansas City urban core and south or southwest of the monitors with the highest design values (KCI, and Liberty; Rocky Creek is too new to have established a design value). The Kansas City International Airport (MCI) wind rose (Figure 5) representing the most current three years of ozone season data shows that emissions from Wyandotte County would be very likely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses (the closest weather station to Wyandotte County) for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show potential for Wyandotte County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Wyandotte County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Wyandotte County in 2000 was 157,882, or 9% of the population of the MSA. Wyandotte County's population decreased 3% from 1990 to 2000. Projections show a further population decrease of 0.3% from 2000 to 2010. The population density of Wyandotte is 1,043 persons per square mile.

Transportation: Average daily VMT in 1999 for Wyandotte County was 4,668,108 miles, or 9% of the total average daily VMT for the MSA. The county's average daily VMT is projected to grow to 6,623,546 by 2012, a 42% increase from 1999 levels.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Wyandotte County, 51% leave the county, and 49% remain in the county. The commuters that leave the county primarily travel to Johnson and Jackson counties. Of the total number of work trips with Wyandotte County as a destination, 56% begin outside the county, and 44% originate within Wyandotte County. Of those trips originating outside the county, most start in Jackson and Platte counties. Overall, the commuters residing in Wyandotte County contribute about 8% of the work trips originating in the MSA, and the county receives about 8% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	18,996
Leavenworth (KS)	612
Miami (KS)	63
Wyandotte (KS)	31,919
Douglas (KS)	200
Cass (MO)	75
Clinton (MO)	0
Clay (MO)	1,707
Jackson (MO)	11,004
Lafayette (MO)	3
Platte (MO)	1,163
Ray (MO)	0
Total	**65,742**

From where do the county's commuters come?

Johnson (KS)	14,791
Leavenworth (KS)	3,793
Miami (KS)	427
Wyandotte (KS)	31,919
Douglas (KS)	796
Cass (MO)	977
Clinton (MO)	291
Clay (MO)	4,267
Jackson (MO)	11,585
Lafayette (MO)	281
Platte (MO)	2,452
Ray (MO)	300
Total	**71,879**

Geography/topography: The main topographic features of Wyandotte County are the valleys of the Kansas and Missouri Rivers and their tributaries. The Missouri River Valley, 2 to 3 miles wide, is along the eastern and northern boundaries of the county. The Kansas River Valley, slightly more than 1 mile wide, is along the southern boundary. The lowest point in Wyandotte County is about 740 feet above sea level at the junction of the Kansas and Missouri Rivers. The highest point is about 1,060 feet on the uplands in the western part of the county. The area of Wyandotte County is 151 square miles. The Kansas River flood plain located on the southern border of Wyandotte County has the potential to provide a preferential pathway for ozone precursors and ozone in an easterly direction on days when high pressure systems do not allow dispersion. The topography of the balance of Wyandotte County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Wyandotte County is located within the current 1-hour ozone maintenance area. It is within the Kansas City MSA. It is within the Kansas City MPO boundary.

Level of control of emission sources: Level of control of emission sources: Emissions sources in Wyandotte County are subject to the Kansas Air Quality Regulations generally, which include the state regulations adopting the Federal New Source Performance Standards (NSPS), the Federal National Emission Standards for Hazardous Air Pollutants (NESHAP), and the Federal National Emission Standards for Hazardous Air Pollutants for Source Categories (MACT standards, for maximum achievable control technology). In addition, the state has adopted RACT rules to control sources of VOCs within the existing nonattainment area counties. These RACT rules are contained in K.A.R. 28-

19-61 through 77, and 28-19-714. They address the following sources of VOC emissions: surface coating; gasoline loading terminals; gasoline service stations - Stage I; petroleum storage tanks; refinery sources; cutback asphalt; solvent metal cleaning; printing; gasoline tank truck leaks; fiberglass manufacturing; detergent and chemical processing facilities; commercial bakeries; and solvent metal cleaning. An additional VOC control measure is the low-volatility fuel regulation, K.A.R. 28-19-719, which restricts the volatility of motor vehicle fuel during the ozone season in Johnson and Wyandotte Counties.

New and modified sources, prior to construction of a source in the Kansas City Maintenance Area must meet the applicable best available control technology (BACT) requirements if subject to the prevention of significant deterioration (PSD) program, or for minor sources, the appropriate levels, which may be RACT

Regional emissions reductions: The state of Kansas has not adopted any regional or statewide NOx or VOC control regulations more stringent than those contained in the federal air program.

Summary: Wyandotte County is centrally located in the MSA. Meteorological conditions support strong contribution to ozone formation in the MSA. It has the third largest NOx and VOC emissions; the fourth largest population; the second greatest population density; and the fourth largest ADVMT in the MSA. It is located in the current 1-hour maintenance area and the MSA There are no criteria that do not support including Wyandotte County in the 8-hour designation area.

Recommendation: It is recommended that Wyandotte County be included in the area designated nonattainment for the 8-hour ozone standard for the Kansas City area.

Cass County

Air Quality: There was one ozone monitor operating in Cass County during the three-year period being evaluated for the designation process. The monitor is located at Richards Gebaur Airbase in the northwest corner of Cass County. This monitor has an 8-hour design value of 0.079 ppm.

Emissions: Total Cass County NOx emissions for 1999 were 4,202 tons. This represents 3% of the total NOx emissions for the Kansas City MSA. Point source emissions were 90 tons of this total. Area source emissions were 1,435 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth, which is projected to be a 23% increase from 2000 through 2010. Mobile source NOx emissions were 2,677 tons. No information on point or mobile NOx emissions growth is available.

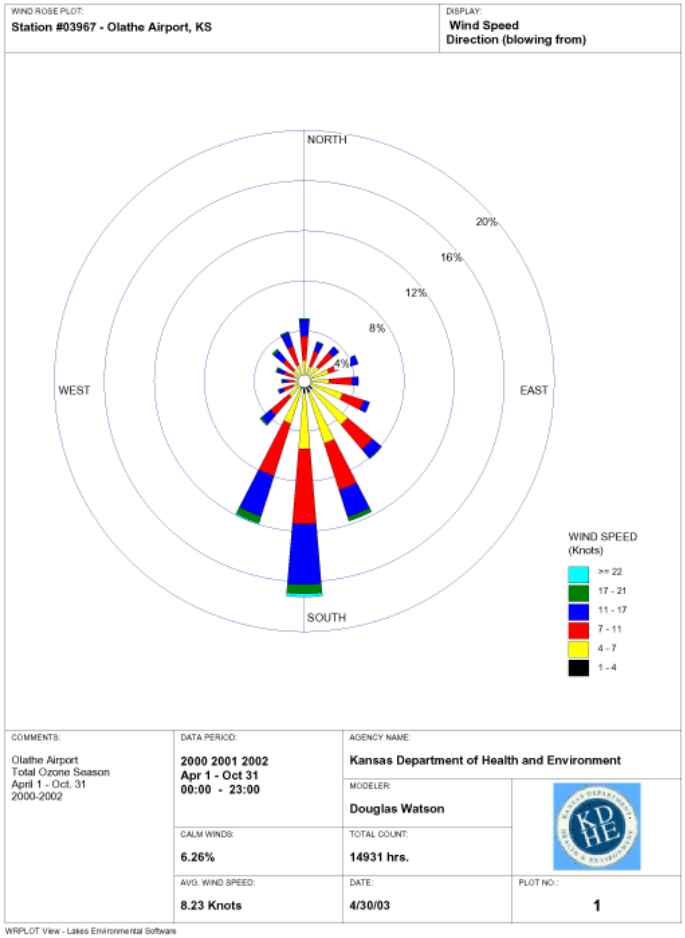


Figure 7

Total Cass County VOC emissions for 1999 were 4,727 tons. This represents 5% of the total VOC emissions for the MSA. Point source emissions were 11 tons of this total. Area source VOC emissions were 2,920 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth, which is a 23% increase from 2000 through 2010. Mobile source VOC emissions were 1,797 tons. No information on point or mobile VOC emissions growth is available.

Meteorological Conditions: Cass County is located generally south of the Kansas City urban core and south or south-southeast of the monitors with the highest design values (KCI, and Liberty; Rocky Creek

is too new to have established a design value). The Olathe Executive Airport (OJC) wind rose (Figure 6) representing the most current three years of ozone season data shows that emissions from Cass County could potentially participate in ozone formation in the Kansas City area.

Olathe (OJC) wind roses (the closest weather station to Cass County) for the ozone season show predominate winds from the south, with occasional variances from the southwest and southeast and show very little potential for Cass County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Cass County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Cass County in 2000 was 82,092, or 5% of the population of the MSA. Cass County's population increased 29% from 1990 to 2000. The growth has occurred primarily in the northern portions of the county in the cities of Raymore, Pleasant Hill, and Peculiar. The county population is projected to grow 23% from 2000 to 2010. The population density of Cass County is 117 persons per square mile.

Transportation: Average daily VMT in 1999 for Cass County was 2,680,904 miles, or 5% of the total average daily VMT for the MSA. No reliable information concerning expected growth of VMT in the county is available.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Cass County, 63% leave the county, and 37% remain in the county. The commuters that leave the county primarily travel to Jackson and Johnson Counties. Of the total number of work trips with Cass County as a destination, 21% begin outside the county, and 79% originate within Cass County. Of those trips originating outside the county, most start in Jackson County. Overall, the commuters residing in Cass County contribute about 5% of the work trips originating in the MSA, and the county receives about 2% of the work trips that end the MSA.

To where do the county's commuters go?

Johnson (KS)	6,686
Leavenworth (KS)	10
Miami (KS)	224
Wyandotte (KS)	977
Douglas (KS)	38
Cass (MO)	14,616
Clinton (MO)	0
Clay (MO)	816
Jackson (MO)	16,208
Lafayette (MO)	42
Platte (MO)	216
Ray (MO)	5
Total	**39,838**

From where do the county's commuters come?

Johnson (KS)	587
Leavenworth (KS)	72
Miami (KS)	94
Wyandotte (KS)	75
Douglas (KS)	8
Cass (MO)	14,616
Clinton (MO)	5
Clay (MO)	113
Jackson (MO)	2,777
Lafayette (MO)	93
Platte (MO)	26
Ray (MO)	4
Total	**18,470**

Geography/topography: The South Grand River is the largest stream in the county. Most of the county drains to the south and east into the South Grand River and Big Creek, which is a tributary of the South Grand River. A minor part of the county drains northward into the Blue and Little Blue Rivers. Elevation ranges from about 730 feet, where the South Grand River leaves the county, to 1,120 feet above sea level near the town of Belton in the northwest corner of the county. Cass County has a total area of 449,498 acres or 702.34 square miles. The topography of Cass County should have very little discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Cass County is located within the Kansas City MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City Metropolitan Planning Organization boundary.

Level of control of emission sources: The emissions sources are subject to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards. Also, the State of Missouri has submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is an ozone precursor.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input.

Clay County

Air Quality: There were three ozone monitors operating in Clay County during the three-year period being evaluated for the designation process. These include the Watkins Mill monitor located in northeastern Clay County, the Liberty monitor located in central Clay County and the Rocky Creek monitor located in eastern Clay County. The first two monitors show 8-hour design values of 0.080 ppm and 0.085 ppm, respectively. The Rocky Creek monitor has operated for one year and shows a 4th high value for the year of 0.091 ppm. The Rocky Creek monitoring results for 2002 were significantly higher than all other sites in the Kansas City area. Clay County would represent a large population exposure to high ozone levels (184,006 persons in 2000 census).

Emissions: Total Clay County NOx emissions for 1999 were 9,699 tons. This represents 7% of the total NOx emissions for the Kansas City MSA. Point source emissions were 594 tons of this total, with the bulk (384 tons) emitted by the Independence Power and Light power plant located in the southeast corner of the county. Projected growth of NOx point source emissions is 44% from 1999 through 2012. Projected growth of point source emissions in the SIC category that includes electricity generation is 37%. Area source emissions were 3,209 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth, which is a 15% increase from 2000 through 2010. Mobile source NOx emissions were 5,896 tons. Mobile source NOx emissions in the county are projected to decrease 55% from 1999 to 2012.

Total Clay County VOC emissions for 1999 were 11,125 tons. This represents 11% of the total VOC emissions for the Kansas City MSA. Point source emissions were 2,235 tons of this total, with the majority of the emissions (1,743 tons) coming from the Ford Motor Company automobile manufacturing facility in the southeastern portion of the county. Projected growth of VOC point source emissions is 71% from 1999 through 2012. Projected growth of point source emissions in the SIC category that includes automobile manufacturing is 83%. Area source VOC emissions were 4,440 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth, which is a 15% increase from 2000 through 2010. Mobile source VOC emissions were 4,450 tons. Mobile source VOC emissions in the county are projected to decrease 54% from 1999 to 2012.

Meteorological Conditions: The southwest portion of Clay County is part of the Kansas City urban core. Most of the county emissions sources are concentrated in the southwest corner of the county and are south of Rocky Creek and southwest of Liberty and Watkins Mill monitors. The Kansas City International Airport (MCI) wind rose (Figure 7) representing the most current three years of ozone season data shows that emissions from Clay County would be very likely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show very high potential for Clay County

population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Clay County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Clay County in 2000 was 184,006, or 10% of the population of the MSA. The county's population increased 20% from 1990 to 2000. The growth has occurred primarily in the City of Kansas City, with Liberty and Kearney experiencing population growth also. The county's population is projected to grow 15% from 2000 to 2010. The population density of Clay is 464 persons per square mile.

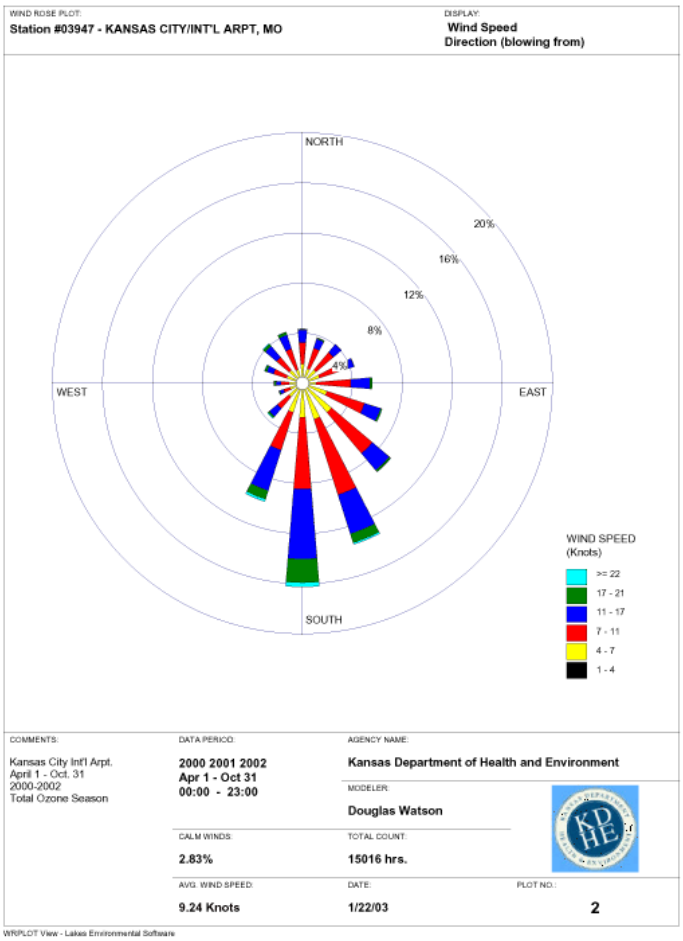


Figure 8

Transportation: Average daily VMT in 1999 for Clay County was 6,317,145 miles, or 12% of the total VMT for the MSA. The county's average daily VMT is projected to grow to 8,269,326 by 2012, a 31% increase from 1999 levels.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Clay County, 50% leave the county, and 50% remain in the county. The commuters that leave the county primarily travel to Jackson and Platte Counties. Of the total number of work trips with Clay County as a destination, 43% begin outside the county, and 57% originate within Clay County. Of those trips originating outside the county, most start in Jackson and Platte Counties. Overall, the commuters residing in Clay County contribute about 11% of the work trips originating in the MSA, and the county receives about 10% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	5,938
Leavenworth (KS)	229
Miami (KS)	8
Wyandotte (KS)	4,267
Douglas (KS)	75
Cass (MO)	113
Clinton (MO)	194
Clay (MO)	47,238
Jackson (MO)	26,812
Lafayette (MO)	11
Platte (MO)	10,039
Ray (MO)	372
Total	**95,296**

From where do the county's commuters come?

Johnson (KS)	3,766
Leavenworth (KS)	351
Miami (KS)	70
Wyandotte (KS)	1,707
Douglas (KS)	149
Cass (MO)	816
Clinton (MO)	2,257
Clay (MO)	47,238
Jackson (MO)	14,451
Lafayette (MO)	502
Platte (MO)	7,119
Ray (MO)	3,806
Total	**82,232**

Geography/topography: Clay County has a total area of 369 square miles. It is in several physiographic areas. The southern part of the county is the flood plain along the Missouri River. This flood plain is less than 1/4 mile to about 7 miles wide at the widest point. It generally is level or nearly level, but the slope is more than 5 percent on some of the old natural levees. The uplands are highly dissected glacial till plains. Elevation ranges from about 670 feet above sea level in an area on the Missouri River in the southeast corner, to about 1,100 feet on the highest ridges in the uplands. The Missouri River flood plain, located on the southern border of Clay County has the potential to provide a preferential pathway for ozone precursors and ozone both in and out of the Kansas City metro area. The prevailing wind directions during the ozone season indicate that such localized transport is more likely to occur out of the Kansas City area.

Jurisdictional boundaries: Clay County is located within the Kansas City MSA. It is part of the current 1-hour ozone maintenance area. The southern portion of the county is within the Kansas City MPO boundary.

Level of control of emission sources: There are several point and area source regulations in place in the Missouri portion of the maintenance area. In addition to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards, the following rules affect the Missouri sources within the maintenance area: aerospace manufacturing/rework; solvent metal cleaning; solvent cleanup operations; liquified cutback asphalt; industrial surface coating; petroleum storage/transfer (Stage I); rotogravure/flexographic printing; manufacturing of paint, laquer, varnish, enamels; application of

automotive underbody deadeners; pesticide and herbicide production; lithographic printing; and bakery ovens (commercial). The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Missouri has also adopted a fuel volatility regulation, which applies to the three maintenance area counties and has the same volatility limit as the fuel regulation for Kansas during the ozone season.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Clinton County

Air Quality: There were no ozone monitors operating in Clinton County during the three-year period being evaluated for the designation process. The closest monitor is the Watkins Mill monitor located in the northeast corner of Clay County. This monitor has an 8-hour design value of 0.080 ppm.

Emissions: Total Clinton County NOx emissions for 1999 were 1,644 tons. This represents 1% of the total NOx emissions for the Kansas City MSA. Point source NOx emissions in 1999 were insignificant (0.04 tons). Area source NOx emissions were 335 tons, and mobile source NOx emissions were 1,309 tons.

Total Clinton County VOC emissions for 1999 were 1,629 tons. This represents 2% of the total VOC emissions for the MSA. Point source VOC emissions were 5 tons of this total. Area source VOC emissions were 969 tons, and mobile source VOC emissions were 655 tons.

No information regarding emissions growth in the county is available.

Meteorological Conditions: Clinton County is located north-northeast of the Kansas City urban core and north of the Clay County monitors. The Kansas City International Airport (MCI) wind rose (Figure 8) representing the most current three years of ozone season data shows that emissions from Clinton County would be unlikely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show a potential for Clinton County population being affected by short range transport of ozone from the Kansas City urban core area.

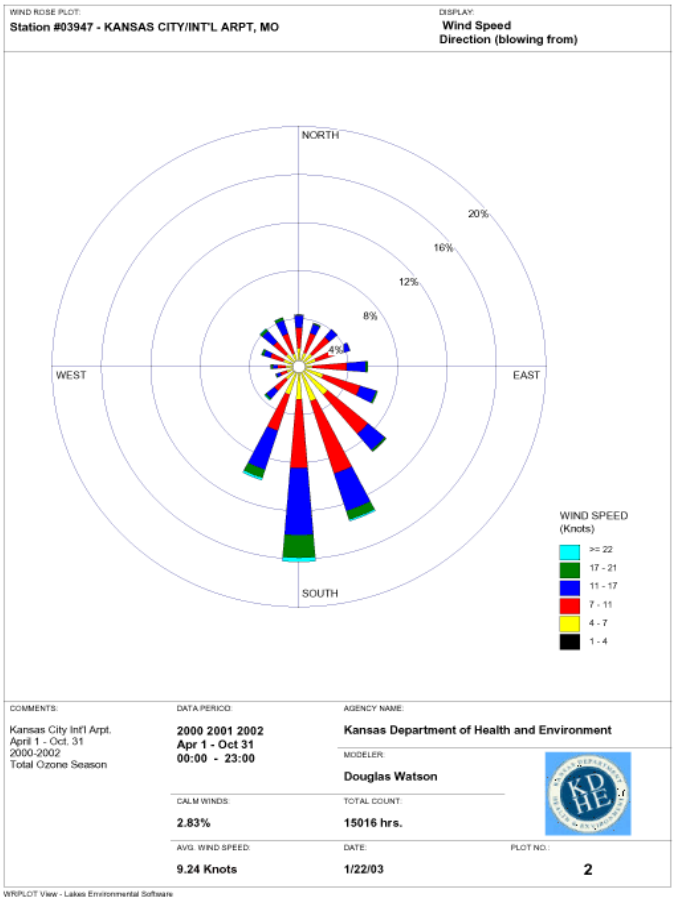


Figure 9

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Clinton county is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Clinton County in 2000 was 18,979, or 1% of the population of the Kansas City MSA. Clinton County has experienced a growth rate of 14% from 1990 to 2000. Projected population growth for Clinton County is not available. The majority of future growth is expected to be low-density residential in the southeast and southwest areas of the county. The population density of Clinton County is 45 persons per square mile.

Transportation: Average daily VMT in 1999 for Clinton County was 917,787 miles, or 2% of the total average daily VMT for the MSA. No reliable information concerning expected growth of VMT in the county is available.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Clinton County, 58% leave the county, and 42% remain in the County. The commuters that leave the county primarily travel to Clay and Jackson Counties. Of the total number of work trips with Clinton County as a destination, 10% begin outside the county, and 90% originate within Clinton County. Of those trips originating outside the county, most start in Clay County. Overall, the commuters residing in Clinton County contribute about 1% of the work trips originating in the MSA, and the county receives about 0.4% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	146
Leavenworth (KS)	17
Miami (KS)	0
Wyandotte (KS)	291
Douglas (KS)	16
Cass (MO)	5
Clinton (MO)	3,015
Clay (MO)	2,257
Jackson (MO)	1,004
Lafayette (MO)	6
Platte (MO)	441
Ray (MO)	47
Total	**7,245**

From where do the county's commuters come?

Johnson (KS)	0
Leavenworth (KS)	0
Miami (KS)	0
Wyandotte (KS)	0
Douglas (KS)	0
Cass (MO)	0
Clinton (MO)	3,015
Clay (MO)	194
Jackson (MO)	36
Lafayette (MO)	2
Platte (MO)	64
Ray (MO)	32
Total	**3,343**

Geography/topography: The landscape in Clinton County is mainly gently sloping to strongly sloping upland. A system of wide, gently sloping ridges extends southward through the county, beginning in the north-central part. The county drains generally to the south. The northeastern part, however, drains to the north and east. The county takes in an area of 268,800 acres, or 420 square miles. The topography of Clinton County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Clinton County is located within the MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City MPO boundary.

Level of control of emission sources: The emissions sources are subject to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards. Also, the State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input.

Jackson County

Air Quality: There were no ozone monitors operating in Jackson County during the three-year period being evaluated for the designation process. The closest monitoring sites to Jackson County are at Richards Gebauer South located in Cass County south of the Kasnas City urban core and at the JFK Community Center northwest of Jackson County in downtown Kansas City, Kansas. Both are located within 1 to 2 miles of the Jackson County border. These two monitors show 8-hour design values of 0.079 ppm and 0.081 ppm respectively.

Emissions: Total Jackson County NOx emissions for 1999 were 57,798 tons. This represents 40% of the total NOx emissions for the Kansas City MSA. Point source emissions were 23,834 tons of this total, with the bulk emitted by the Missouri Public Service power plant (18,863 tons) in the northeastern corner of the county and the Lafarge cement plant (1,190 tons) in the north-central portion. Projected growth of NOx point source emissions is 38% from 1999 through 2012. The projected growth rates of point source emissions in the SIC categories that include electricity generation and cement production are 37% and 70%, respectively. Area source NOx emissions were 12,285 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth (5% increase from 2000 through 2010). Mobile source NOx emissions were 21,679 tons. Mobile source NOx emissions in the county are projected to decrease 52% from 1999 to 2012.

Total Jackson County VOC emissions for 1999 were 32,797 tons. This represents 32% of the total VOC emissions for the MSA. Point source emissions were 1,019 tons of this total, with two facilities having emissions greater than major source thresholds–the Ball metal can manufacturing facility (118 tons) and the Cargill soybean oil mill (272 tons), both located in the northwestern corner of the county. Projected growth of VOC point source emissions is 37% from 1999 through 2012. The projected growth rates of point source emissions in the SIC categories that include metal can and soybean oil production are 72% and 34%, respectively. Area source VOC emissions were 14,188 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth (5% increase from 2000 through 2010). Mobile source VOC emissions were 17,590 tons. Mobile source VOC emissions in the county are projected to decrease 52% from 1999 to 2012.

Meteorological Conditions: The northwest portion of Jackson County is part of the Kansas City urban core. VOC and NOx point sources are primarily clustered in the northwest portion of the county and are located south and southwest of the monitors with the highest ozone concentrations (Liberty, and Rocky Creek). The Kansas City International Airport (MCI) wind rose (Figure 9) representing the most current three years of ozone season data shows that emissions from Jackson County would be very likely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show a high potential for Jackson County population being affected by short range transport of ozone from the Kansas City area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Jackson county is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

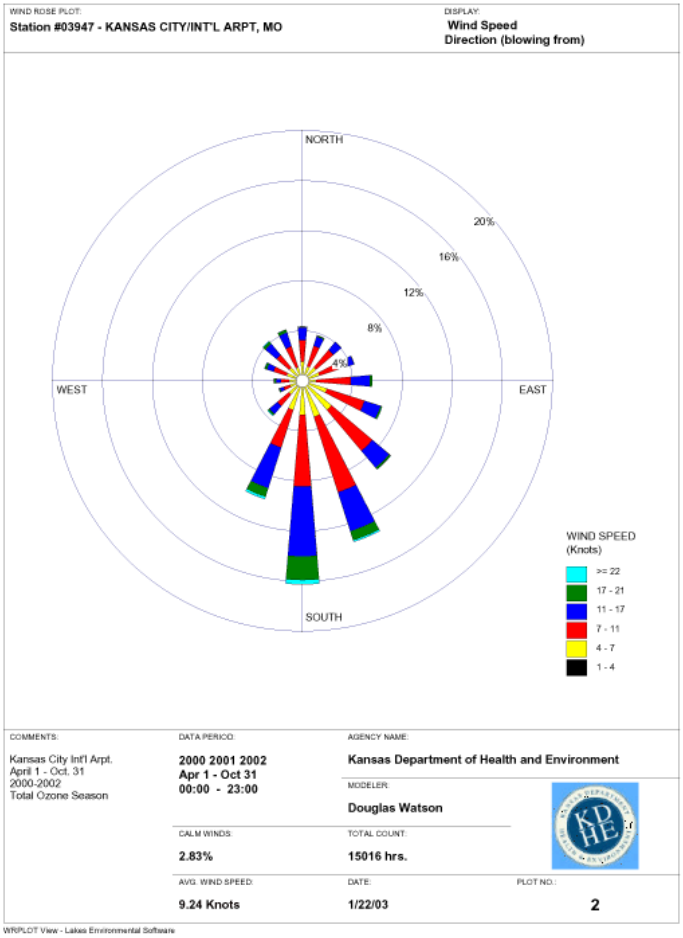


Figure 10

Population/growth: The population of Jackson County in 2000 was 654,880, or 37% of the population of the Kansas City MSA. Jackson County's population increased 3% from 1990 to 2000. The county population is projected to grow 5% from 2000 to 2010. The population density of Jackson is 1,083 persons per square mile.

Transportation: Average daily VMT in 1999 for Jackson County was 18,539,255 miles, or 34% of the total average daily VMT for the MSA. The county's average daily VMT is projected to grow to 25,635,573 by 2012, a 38% increase from 1999 levels.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Jackson County, 24% leave the county, and 76% remain in the county. The commuters that leave the county primarily travel to Johnson, Clay and Wyandotte Counties. Of the total number of work trips with Jackson County as a destination, 35% begin outside the county, and 65% originate within Jackson County. Of those trips originating outside the county, most start in Johnson, Clay and Cass Counties. Overall, the commuters residing in Jackson county contribute about 36% of the work trips originating in the MSA, and the county receives about 41% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	39,018
Leavenworth (KS)	259
Miami (KS)	80
Wyandotte (KS)	11,585
Douglas (KS)	308
Cass (MO)	2,777
Clinton (MO)	36
Clay (MO)	14,451
Jackson (MO)	233,408
Lafayette (MO)	538
Platte (MO)	4,078
Ray (MO)	123
Total	**306,661**

From where do the county's commuters come?

Johnson (KS)	49,687
Leavenworth (KS)	1,701
Miami (KS)	934
Wyandotte (KS)	11,004
Douglas (KS)	1,450
Cass (MO)	16,208
Clinton (MO)	1,004
Clay (MO)	26,812
Jackson (MO)	233,408
Lafayette (MO)	5,184
Platte (MO)	9,548
Ray (MO)	1,794
Total	**358,734**

Geography/topography: The Missouri River flood plain is one of the major physiographic areas in Jackson County. It is in the northern part of the county and ranges from less than 1/4 mile to more than 3 miles wide. Most of the flood plain is level or nearly level, except on some of the old natural levees, where the slope may be more than 5 percent. Adjacent to the flood plain and south are moderately sloping to steep, loess-covered bluffs and hills. The rest of the county consists of gently sloping to moderately sloping uplands and flood plains of the Blue River, Little Blue River, Sni-A-Bar Creek, and their tributaries. The flood plains of these streams are relatively narrow, and the adjacent, moderately sloping to steep uplands have numerous Rock outcrops of limestone. The county has a total area of about 394,419 acres or about 616.3 square miles, which includes about 3,456 acres of water areas more than 40 acres in size. Elevation in Jackson County ranges from 1,105 feet on the divide in the south-central part of the county to 690 feet at normal water level on the Missouri River at the county line on the eastern side of the county. The Missouri River flood plain, located on the northern border of Jackson County has the potential to provide a preferential pathway for ozone precursors and ozone both in and out of the Kansas City metro area. The topography of the balance of Jackson County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Jackson County is located within the Kansas City MSA. It is part of the current 1-hour ozone maintenance area. It is within the Kansas City MPO boundary.

Level of control of emission sources: There are several point and area source regulations in place in the Missouri portion of the maintenance area. In addition to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards, the following rules affect the Missouri sources within

the maintenance area: aerospace manufacturing/rework; solvent metal cleaning; solvent cleanup operations; liquified cutback asphalt; industrial surface coating; petroleum storage/transfer (Stage I); rotogravure/flexographic printing; manufacturing of paint, laquer, varnish, enamels; application of automotive underbody deadeners; pesticide and herbicide production; lithogrphic printing; and bakery ovens (commercial). The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. Missouri has also adopted a fuel volatility regulation, which applies to the three maintenace area counties and has the same volatility limit as the fuel regulation for Kansas during the ozone season.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input.

Lafayette County

Air Quality: There were no ozone monitors operated in Lafayette County during the three year period being evaluated for the designation process. The closest monitor is the Watkins Mill monitor located in the northeast corner of Clay County. This monitor has an 8-hour design value of 0.080 ppm.

Emissions: Total Lafayette County NOx emissions for 1999 were 3,943 tons. This represents 3% of the total NOx emissions for the Kansas City MSA. Point source emissions were 49 tons of this total. Area source NOx emissions were 1,597 tons, and mobile source NOx emissions were 2,297 tons.

Total Lafayette County VOC emissions for 1999 were 3,123 tons. This represents 3% of the total VOC emissions for the MSA. Point source emissions were 181 tons of this total, with none of the facilities having emissions greater than the major source threshold. Area source VOC emissions were 1,803 tons. Mobile source VOC emissions were 1,139 tons.

No information regarding projected NOx or VOC emissions in the county is available.

Meteorological Conditions: Lafayette County is located east of the Kansas City urban core and east-southeast of the monitors with the highest design values (KCI, Liberty, and Rocky Creek). The Kansas City International Airport (MCI) wind rose (Figure 10) representing the most current three years of ozone season data shows that emissions from Lafayette County would be unlikely to participate in ozone formation in the Kansas City area.

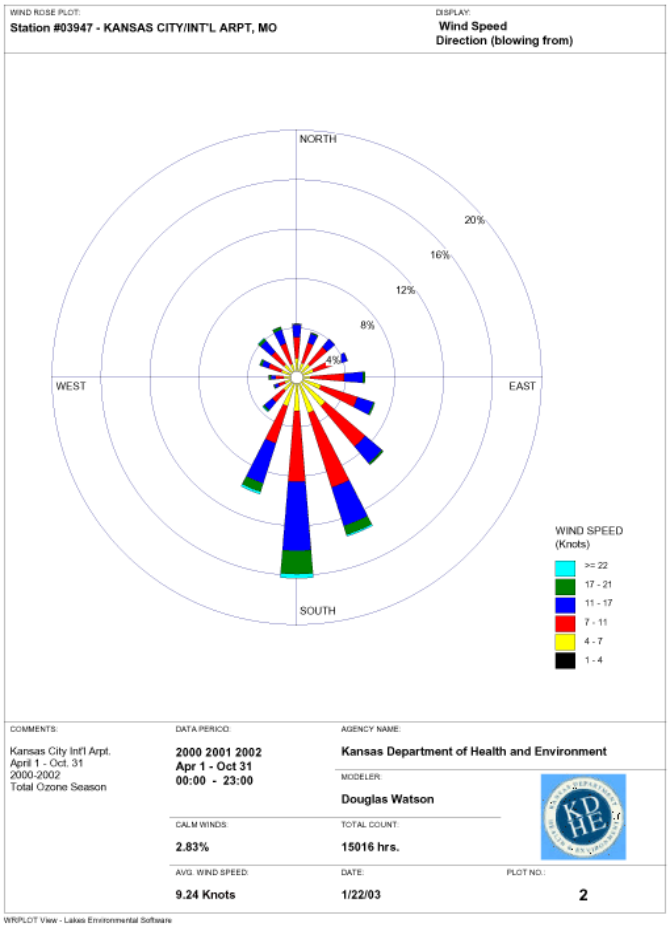


Figure 11

Kansas City (MCI) wind roses (the closest weather station to Lafayette County) for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show little potential for Lafayette County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Lafayette county is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Lafayette County in 2000 was 32,960, or 2 % of the population of the Kansas City MSA. Lafayette County's population increased 6% from 1990 to 2000. Population projections are not currently available. The population density of Lafayette is 52 persons per square mile.

Transportation: Average daily VMT in 1999 for Lafayette County was 1,955,389 miles, or 4% of the total average daily VMT for the MSA. No information regarding expected VMT growth in the county is available. The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Lafayette County, 46% leave the county, and 54% remain in the county. The commuters that leave the county primarily travel to Jackson County. Of the total number of work trips with Lafayette County as a destination, 11% begin outside the county, and 89% originate within Lafayette County. Of those trips originating outside the county, most start in Jackson County. Overall, the commuters residing in Clinton County contribute about 2% of the work trips originating in the MSA, and the county receives about 1% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	341
Leavenworth (KS)	5
Miami (KS)	7
Wyandotte (KS)	281
Douglas (KS)	2
Cass (MO)	93
Clinton (MO)	2
Clay (MO)	502
Jackson (MO)	5,184
Lafayette (MO)	7,926
Platte (MO)	72
Ray (MO)	258
Total	**14,673**

From where do the county's commuters come?

Johnson (KS)	33
Leavenworth (KS)	7
Miami (KS)	7
Wyandotte (KS)	3
Douglas (KS)	0
Cass (MO)	42
Clinton (MO)	6
Clay (MO)	11
Jackson (MO)	538
Lafayette (MO)	7,926
Platte (MO)	17
Ray (MO)	297
Total	**8,887**

Geography/topography: Lafayette County has a total area of 629 square miles. The topography of

Lafayette County may be divided into three distinct regions. Along the northern edge of the county is the wide bottom land area of the Missouri River. This area is level or nearly level and has the lowest elevation in the county. Adjacent to the Missouri River. This area is level or nearly level and has the low-commonly called the River Hills. Slopes range from level or nearly level on the ridgetops to steep on the hillsides. This area has many deep gullies and ravines caused by the eroding away of the deep wind-deposited soil material. The rest of the county is a plain where slopes range from level or nearly level to sloping. Rising above this plain are a number of isolated hills and ridges where slopes range from gently sloping to moderately steep. These hills and ridges are at the highest elevation in the county. Cutting through the plain are many small to moderately large stream valleys where slopes range from level or nearly level on the valley floor to moderately steep on the sides of valleys. The topography of Lafayette County should have very little discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Lafayette County is located within the Kansas City MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City Metropolitan Planning Organization boundary.

Level of control of emission sources: The emissions sources are subject to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards. Also, the State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input.

Platte County

Air Quality: There was one ozone monitor operating in Platte County during the three-year period being evaluated for the designation process. The monitor is located at the KCI airport in south-central Platte County. The 8-hour design value for the monitor was 0.084 ppm.

Emissions: Total Platte County NOx emissions for 1999 were 12,561 tons. This represents 9% of the total NOx emissions for the Kansas City MSA. Point source emissions were 6,513 tons of this total, with the bulk (6,430 tons) emitted by the Kansas City Power and Light power plant located in the northwestern corner of the county. Projected growth of NOx point source emissions is 37% from 1999 through 2012. The projected growth rate of point source emissions in the SIC category that includes electricity generation is 37%. Area source emissions were 2,768 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth, which is a 20% increase from 2000 through 2010.
Mobile source NOx emissions were 3,281 tons. The county's mobile source NOx emissions are projected to decrease 55% from 1999 to 2012.

Total Platte County VOC emissions for 1999 were 4,746 tons, representing 5% of the total VOC emissions for the MSA.
Point source emissions were 243 tons of this total, with none of the facilities having emissions greater than the major source threshold. Projected growth of VOC point source emissions is 34% from 1999 through 2012. Area source VOC emissions were 2,459 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth, which is a 20% increase from 2000 through 2010.
Mobile source VOC emissions were 2,044 tons. The county's mobile source VOC emissions are projected to decrease 55% from 1999 to 2012.

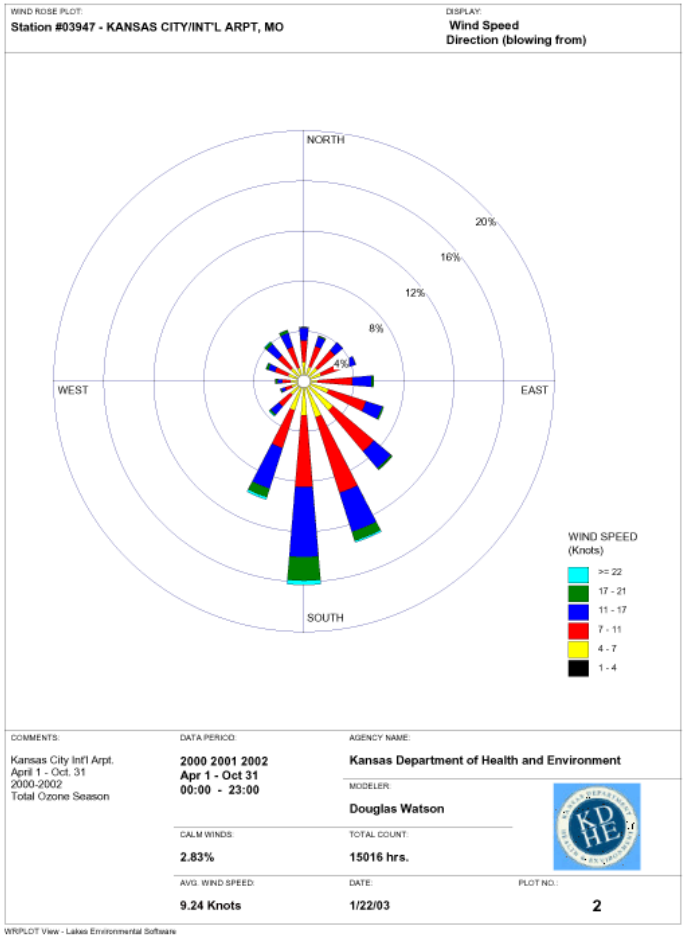


Figure 12

Meteorological Conditions: Platte County is located northwest of the Kansas City urban core. Most

of the county point sources are located generally west and north-northwest of Clay County monitors. The Kansas City International Airport (MCI) wind rose (Figure 11) representing the most current three years of ozone season data shows that emissions from Platte County would be unlikely to participate in ozone formation in the Kansas City area.

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show some potential for Platte County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Platte County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Platte County was 184,006, or 10% of the population of the MSA. The county's population increased 28% from 1990 to 2000. The growth has occurred primarily in the southeastern corner of the county. The county population is projected to grow 20% from 2000 to 2010. The population density of Platte is 176 persons per square mile.

Transportation: Average daily VMT in 1999 for Platte County was 3,159,378 miles, or 6% of the total average daily VMT for the MSA. The county's average daily VMT is projected to grow to 4,100,878 by 2012, a 30% increase from 1999 levels.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Platte County, 59% leave the county, and 41% remain in the county. The commuters that leave the county primarily travel to Jackson and Clay Counties. Of the total number of work trips with Platte County as a destination, 54% begin outside the county, and 46% originate within Platte County. Of those trips originating outside the county, most start in Clay and Jackson Counties. Overall, the commuters residing in Platte County contribute about 5% of the work trips originating in the MSA, and the county receives about 4% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	3,304
Leavenworth (KS)	793
Miami (KS)	10
Wyandotte (KS)	2,452
Douglas (KS)	32
Cass (MO)	26
Clinton (MO)	64
Clay (MO)	7,119
Jackson (MO)	9,548
Lafayette (MO)	17
Platte (MO)	16,264
Ray (MO)	9
Total	**39,638**

From where do the county's commuters come?

Johnson (KS)	1,984
Leavenworth (KS)	712
Miami (KS)	31
Wyandotte (KS)	1,163
Douglas (KS)	60
Cass (MO)	216
Clinton (MO)	441
Clay (MO)	10,039
Jackson (MO)	4,078
Lafayette (MO)	72
Platte (MO)	16,264
Ray (MO)	246
Total	**35,306**

Geography/topography: Relief in Platte County ranges from 1,190 feet near the headwaters of Bear Creek, in the northwest, to 730 feet at the point where the Missouri River leaves the county, in the southeast. Local relief varies as much as 310 feet from the crest of the River Bluff to the Missouri River flood plain north of Weston. The county has a total of 273,478 acres, or 427.3 square miles. The Missouri River flood plain has the potential to provide a preferential pathway for ozone precursors and ozone both in and out of the Kansas City metro area. The Missouri River flood plain is located on the western border of Platte County. Prevailing winds during the ozone season indicate that such localized transport along the Missouri River is more likely to occur from the Kansas City urban core toward Platte County. The topography of the balance of Platte County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Platte County is located within the Kansas City MSA. It is part of the current 1-hour ozone maintenance area. The southern portion of the county is within the Kansas City MPO boundary.

Level of control of emission sources: There are several point and area source regulations in place in the Missouri portion of the maintenance area. In addition to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards, the following rules affect the Missouri sources within the maintenance area: aerospace manufacturing/rework; solvent metal cleaning; solvent cleanup operations; liquified cutback asphalt; industrial surface coating; petroleum storage/transfer (Stage I); rotogravure/flexographic printing; manufacturing of paint, laquer, varnish, enamels; application of automotive underbody deadeners; pesticide and herbicide production; lithogrphic printing; and bakery

ovens (commercial). The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Missouri has also adopted a fuel volatility regulation, which applies to the three maintenace area counties and has the same volatility limit as the fuel regulation for Kansas during the ozone season.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is also an ozone precursor.

Ray County

Air Quality: There were no ozone monitors operating in Ray County during the three year period being evaluated for the designation process. The closest monitor is the Watkins Mill monitor located in northeast Clay County. This monitor has an 8-hour design value of 0.080 ppm.

Emissions: Total Ray County NOx emissions for 1999 were 3,195 tons. This represents 2% of the total NOx emissions for the Kansas City MSA. Point source emissions were 4 tons of this total. Area source NOx emissions were 2,207 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth, which is a 4% increase from 2000 through 2010. Mobile source NOx emissions were 985 tons. No information regarding projected mobile source NOx emissions is available.

Total Ray County VOC emissions for 1999 were 1,887 tons. This represents 2% of the total VOC emissions for the MSA. Point source emissions were 15 tons of this total. Area source VOC emissions were 1,291 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth, which is a 4% increase from 2000 through 2010. Mobile source VOC emissions were 581 tons. No information regarding projected mobile source VOC emissions is available.

Meteorological Conditions: Ray County is located northeast of the Kansas City urban core. Most of the county emissions sources are concentrated in the south part of the county and are east or southeast of the monitors in Clay County. The Kansas City International Airport (MCI) wind rose (Figure 12) representing the most current three years of ozone season data shows that emissions from Ray County would be unlikely to participate in ozone formation in the Kansas City area.

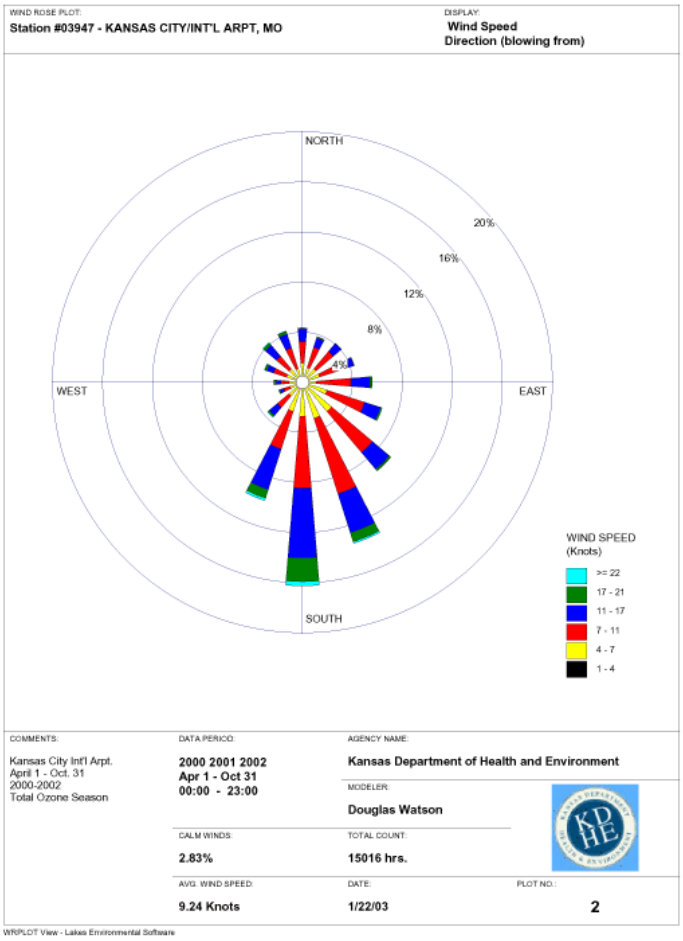


Figure 13

Kansas City (MCI) wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show potential for Ray County population being affected by short range transport of ozone from the Kansas City urban core area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Ray county is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population/growth: The population of Ray County in 2000 was 23,354, or 1 % of the population of the Kansas City MSA. Ray County's population increased 6% from 1990 to 2000. The county population is projected to grow 4% from 2000 to 2010. The population density of Ray County is 41 persons per square mile.

Transportation: Average daily VMT in 1999 for Ray County was 497,002 miles, or 1% of the total average daily VMT for the MSA. No information regarding expected VMT growth in the county is available.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Ray County, 63% leave the county, and 37% remain in the county. The commuters that leave the county primarily travel to Clay County. Of the total number of work trips with Ray County as a destination, 18% begin outside the county, and 82% originate within Ray County. Of those trips originating outside the county, most start in Clay, Lafayette and Jackson Counties. Overall, the commuters residing in Ray County contribute about 1% of the work trips originating in the MSA, and the county receives about 1% of the work trips that end in the MSA.

To where do the county's commuters go?

Johnson (KS)	161
Leavenworth (KS)	2
Miami (KS)	0
Wyandotte (KS)	300
Douglas (KS)	0
Cass (MO)	4
Clinton (MO)	32
Clay (MO)	3,806
Jackson (MO)	1,794
Lafayette (MO)	297
Platte (MO)	246
Ray (MO)	3,883
Total	**10,525**

From where do the county's commuters come?

Johnson (KS)	13
Leavenworth (KS)	0
Miami (KS)	0
Wyandotte (KS)	0
Douglas (KS)	0
Cass (MO)	5
Clinton (MO)	47
Clay (MO)	372
Jackson (MO)	123
Lafayette (MO)	258
Platte (MO)	9
Ray (MO)	3,883
Total	**4,710**

Geography/topography: Ray County has a total area of 569 square miles, covering several physiographic areas. The southern part of the county is the flood plain along the Missouri River. This flood plain is less than 1/4 mile to about 7 miles wide at the widest point. It generally is level or nearly level, but the slope is more than 5 percent on some of the old natural levees. The uplands are highly dissected glacial till plains. Elevation ranges from about 670 feet above sea level in an area on the Missouri River in the southeast corner, to about 1,100 feet on the highest ridges in the uplands. The Missouri River flood plain, located on the southern border of Ray County has the potential to provide a preferential pathway for ozone precursors and ozone both in and out of the Kansas City metro area. Prevailing winds during the ozone season indicates that such localized transport is more likely to occur out of the Kansas City area.

Jurisdictional boundaries: Ray County is located within the Kansas City MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City Metropolitan Planning Organization boundary.

Level of control of emission sources: The emissions sources are subject to the general state regulations adopting the Federal NSPS, NESHAP, and MACT standards. Also, the State of Missouri has submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions to 0.35 lb NOx/MM BTU heat input. NOx is an ozone precursor.

Regional emissions reductions: The State of Missouri has also submitted a SIP revision to incorporate controls on utilities in the western two-thirds of the state. This would limit NOx emissions

to 0.35 lb NOx/MM BTU heat input.

KANSAS NON-MSA COUNTIES

Douglas County

Air Quality: There were no ozone monitors operated in Douglas County during the three-year period from 2000 to 2002. KDHE operated an ozone monitor for the majority of the 2002 ozone monitoring season in the southeast corner of Jefferson County approximately one mile from the Douglas County line. This monitor was located at the KU Field Station in a downwind location from the urban center of the City of Lawrence. The 4th high 8-hour value for the monitor was 0.082 ppm. The highest 8-hour average ozone value measured was 0.084 ppm. The Jefferson County monitor was moved to the Lawrence Municipal Airport, north of the City of Lawrence during the 2003 ozone season.

Emissions: Total Douglas County NOx emissions for 1999 were 11,420 tons. This represents 8% of the total NOx emissions for the Kansas City MSA. Point source emissions were 7,251 tons, with the bulk coming from the Lawrence Energy Center coal-fired power plant (5,656 tons) in the north and the Farmland Industries Nitrogen plant (1,492 tons) in the northeastern part of the county. Point source emissions should remain substantially lower than the 1999 values due to the closure of the Farmland Nitrogen plant. Area source emissions were 1,914 tons. Projected growth of area source NOx emissions can be assumed to correspond closely to projected population growth (5% increase from 2000 through 2010). Mobile source NOx emissions were 2,255 tons. No information regarding point or mobile NOx emissions growth is available.

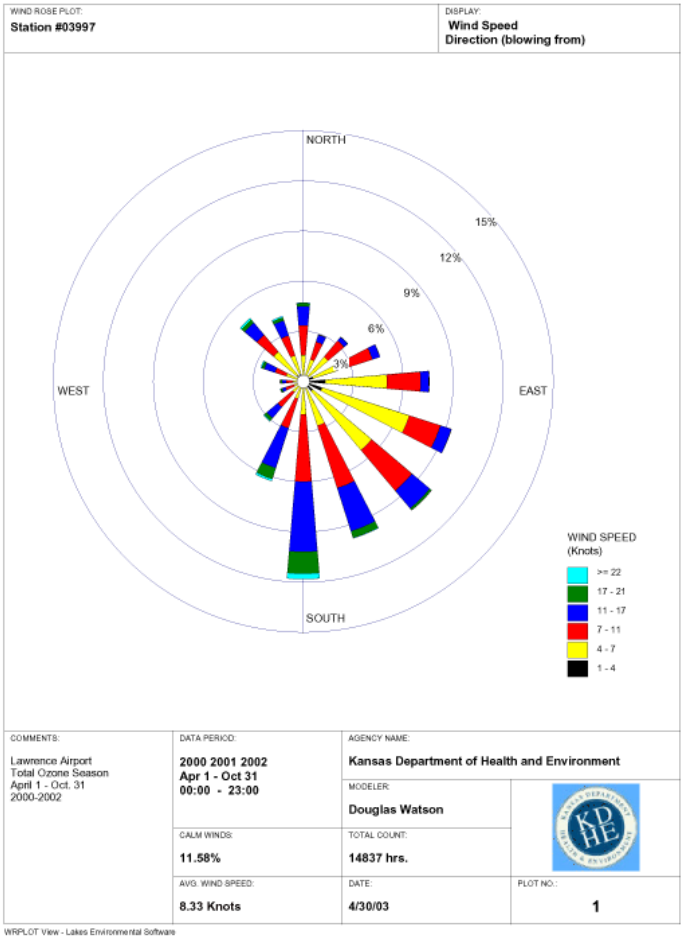


Figure 13

Total Douglas County VOC emissions for 1999 were 4,834 tons. This represents 5% of the total VOC emissions for the Kansas City MSA. Point source VOC emissions were 123 tons, with none of the facilities having emissions greater than the major source threshold. Area

source emissions were 3,082 tons. Projected growth of area source VOC emissions can be assumed to correspond closely to projected population growth (5% increase from 2000 through 2010). Mobile source emissions are 1,629 tons. No information regarding point or mobile VOC emissions growth is available.

Meteorological Conditions: Douglas County is located generally west-southwest of the Kansas City urban core and west-southwest of the monitors with the highest design values (KCI, and Liberty; Rocky Creek is too new to have established a design value). KCI and Lawrence airport wind roses for ozone season days (Figures C-2 and C-13, Appendix C) both show very little potential for contribution of emissions from Douglas County to Kansas City ozone formation.

KCI and Lawrence airport wind roses for the ozone season show predominant winds from the south, with occasional variances from the southwest and southeast and show some potential for Douglas County population being affected by short range transport from the Kansas City area.

Based on ozone season back trajectories for 2000-2002 (Figure C-14, Appendix C), Douglas County is located in the long range transport corridor for ozone and ozone precursors. These back trajectories show a predominant wind flow from the south, southwest with occasional winds from the east or southeast on days with high ozone values.

Population: The population of Douglas County in 2000 was 99,962 persons, or 6% of the population of the Kansas City MSA. The county's population increased 22% from 1990 to 2000. The county's growth has occurred primarily in the City of Lawrence, as well as in Eudora and Baldwin City. The county is projected to grow 5% from 2000 to 2010. The population density of Douglas County is 219 persons per square mile.

Transportation: Average daily VMT in 1999 for Douglas County was 2,387,176 miles, or 4% of the total average daily VMT for the Kansas City MSA. County planning projections show that VMT is expected to reach 3,324,000 by the year 2025, or about a 39% increase.

The following charts summarize the county's commuter trips to, and from, the other counties under consideration. The values in the charts are numbers of round-trip work trips. Of the total number of commuters residing in Douglas county, 17% leave the county for a destination in an MSA county, and 83% remain in the county. The commuters that leave the county primarily travel to Johnson and Jackson counties. Of the total number of work trips with Douglas county as a destination, 7% begin in an MSA county, and 93% originate within Douglas county. Of those trips originating outside the county, most start in Johnson county. Overall, the commuters residing in Douglas county contribute about 6% of the work trips originating in the MSA, and the county is the destination for about 5% of the work trips ending in the MSA.

To where do the county's commuters go?

Johnson (KS)	5,578
Leavenworth (KS)	509
Miami (KS)	58
Wyandotte (KS)	796
Douglas (KS)	41,414
Cass (MO)	8
Clinton (MO)	0
Clay (MO)	149
Jackson (MO)	1,450
Lafayette (MO)	0
Platte (MO)	60
Ray (MO)	0
Total	**50,022**

From where do the county's commuters come?

Johnson (KS)	1,462
Leavenworth (KS)	785
Miami (KS)	120
Wyandotte (KS)	200
Douglas (KS)	41,414
Cass (MO)	38
Clinton (MO)	16
Clay (MO)	75
Jackson (MO)	308
Lafayette (MO)	2
Platte (MO)	32
Ray (MO)	0
Total	**44,452**

Geography/topography: The major topographic features in Douglas County are the east-trending Kansas and Wakarusa River valleys and the upland cuestas formed by differential erosion of the limestone, shale, and sandstone beds. The highest point in the county is in the southwestern part and is about 1,200 feet above sea level; the lowest point is along Kansas River at the east edge of the county, about 778 feet above mean sea level. The Kansas River has an average gradient of about 2 feet per mile. Douglas County has an area of 457 square miles. The topography of Douglas County should have no discernable effect on ozone formation or transport of precursor emissions.

Jurisdictional boundaries: Douglas County is not part of the Kansas City MSA. It is designated as a separate MSA. It is not part of the current 1-hour ozone maintenance area. It is not within the Kansas City Metropolitan Planning Organization boundary.

Level of control of emissions: The emissions sources in Douglas County are subject to state SIP rules and federal rules of general applicability, such as NSPS, NESHAPS, MACT and PSD.

Regional emission reductions: The emission sources in Douglas County are not subject to the NOx SIP call or other enforceable regional strategies.

Summary: Douglas County is located directly west of the Kansas City urban core. Population and emissions sources are concentrated in the northcentral area of the of the County. Wind roses for the ozone season show minimal potential for contribution of Douglas County emissions to ozone formation in the Kansas City MSA. The majority of meteorological regimes associated with high ozone

concentrations in the Kansas City area would not support contribution by precursor emissions from Douglas County. Douglas County is not located in the Kansas City MSA, but is a separate MSA. Douglas County VOC emissions would rank fifth in the Kansas City MSA; NOx emissions would rank fifth in the Kansas City MSA; population would rank fifth in the Kansas City MSA; population density would rank fifth in the MSA; and ADVMT would rank seventh in the Kansas City MSA. While these emissions are fairly substantial in relation to the overall emissions of the Kansas City MSA, their potential for contribution to ozone formation in Kansas City is minimal due to the meteorological conditions described above.

There were no ozone monitors operating in Douglas County during the three year time period from 2000 to 2002. KDHE operated an ozone monitor just north of the Lawrence urban core in Jefferson County in the summer of 2002. No violations of the standard were monitored. With one year's data showing no violations of the standard, and historical data demonstrating the highest readings normally occurring north of the Kansas City urban core, ozone levels in Douglas County can not be established in violation of the 8-hour ozone standard.

Recommendation. It is recommended that Douglas County be excluded from the area designated nonattainment in and around Kansas City for the 8-hour ozone standard. There is no evidence that controlling ozone precursor emissions, either current or projected, in Douglas County will contribute to the goal of attaining the 8-hour standard in Kansas City. There is no evidence that Douglas County residents are exposed to ozone concentrations exceeding the 8-hour ozone standard.

Linn County/La Cygne: Linn County is a rural county south of the MSA. Linn County has a very small population; very low ozone precursor emissions not associated with the La Cygne power generating facility; and very low ADVMT. It is not part of the MSA; not part of the current maintenance area, and not part of the MPO.

The sole reason for considering inclusion of Linn County within the Kansas City nonattainment area is emissions from the La Cygne Generating Station, a very large NOx source located in northeast Linn County. The generating station is located approximately 60 miles south of the Kansas City urban core. The facility has two generating units characterized in Table 1. La Cygne's annual NOx emissions from 1999-2002 are summarized in Table 2.

Table 1. La Cygne generating station units.

Facility Unit	**Unit Capacity (MW)**	**Coal Source**	**Height (ft.)**	**Nitrogen Oxides (NOx) Limits**	**Control Equipment**
Unit 1	893.4	85% Powder River Basin sub-bituminous 15% local bituminous	700	1.04 lb/MMBTU	None
Unit 2	685.17	Power River Basin sub-bituminous	700	0.31 lb/MMBTU	Older low NOx Burners

Table 2. Annual NOx emissions

Year	1999	2000	2001	2002
NOx (tons)	35,267	33,277	24,229	37,380

In order to investigate the potential contribution to ozone formation in Kansas City, a study (Sonoma Technology, Inc. February 1998) was commissioned by KCP&L and Western Resources in 1997. The objective was to determine the extent that ozone in Kansas City was associated with NOx emissions from La Cygne. Two episodes, June 20, 1995 and July 11-13, 1996 were modeled. To estimate the dispersion of the La Cygne NOx plume and thus characterize the potential impact these emissions may have on ozone formation, a puff model (SCIPUFF) was chosen. Meteorological inputs for the model were derived using the CALMET model. Meteorological inputs were derived from surface station observations located within the modeling domain.

The study concluded that NOx from the La Cygne plume would, at most, add 5-15 ppb for a 1-hour contribution and less than 9 ppb for an eight-hour contribution, although only 1-hour exceedance days were considered in the study. The authors also concluded that emissions from La Cygne were not likely to be a measurable contributor to exceedances of the 1-hour or 8-hour standards in Kansas City.

The 8-hour ozone designation process has heightened the need to better understand the impacts La Cygne has on ozone formation in the Kansas City area. Because photochemical modeling of this individual source will not be available for this designation process, KDHE with assistance from EPA Region 7 is working on an updated modeling study to address the issue. The study will take two episodes, August 17-22, 1998, chosen from a separate study (ENVIRON 2001) and July 5-11, 2002, chosen by EPA Region 7. The MM5 runs have already been completed for these episodes. These meteorological inputs will be transformed for use as inputs with CALMET. Once CALMET has been run, outputs will be used to feed CALPUFF, a transport model. Emission rates will be gathered on an hourly basis from available CEM data for La Cygne over these two episodes. CALPUFF will then be run for these two episodes with results being spatially distributed hourly NOx concentration values due to emissions from La Cygne power plant. Concentrations will be graphically displayed using PAVE, a visualization software package. Although chemistry, deposition and actual ozone formation are not considered in this modeling, the results will allow for a preliminary determination of the potential impact of La Cygne emissions on two 8-hour ozone episodes.

There are several notable differences between the Sonoma and KDHE/EPA studies. The Sonoma study was concerned with 1-hour ozone concentrations while KDHE/EPA are interested in evaluating the impact on 8-hour ozone values. The episodes selected in the KDHE/EPA study met EPA's criteria for 8-hour ozone episode selection and include more recent episodes. The duration of the KDHE/EPA episodes (7days) is also much longer than the 1 and 3 day episodes evaluated in the Sonoma study. The meteorological inputs to CALMET are more robust. These improved meteorological outputs should provide a more accurate dispersion result from the final CALPUFF modeling runs. Finally, several years have passed since the initial La Cygne study in 1997. Because of this it is anticipated that the science algorithms have improved for both CALPUFF and SCIPUFF and better observational meteorological data sets are now available.

Recommendation: The results of this study and sensitivity analyses that will be performed as part of the ongoing Kansas City photochemical modeling effort will provide for an informed decision about the relative impact of the La Cygne facility on Kansas City ozone formation. If it is determined that emissions from the source are contributing to ozone formation in the Kansas City area, those emissions can be addressed without designating the county nonattainment. It is recommended that Linn County not be included in the area designated nonattainment for the 8-hour ozone standard for the Kansas City area.

APPENDIX A
Air Quality Data

Table A-1. 8-Hour Ozone Monitoring Data for Kansas City

	4th-High 8-Hour Values (ppm)			
Site Name	**2000**	**2001**	**2002**	**00-02 Average**
JFK Community Center	0.087	0.076	0.080	0.081
KCI Airport	0.090	0.079	0.085	0.084
Liberty	0.091	0.079	0.087	**0.085***
Richards-Gebaur South	0.084	0.072	0.083	0.079
Rocky Creek	na	na	0.091	na
Watkins Mill	0.084	0.073	0.083	0.080
World of Fun	0.088	0.077	na	na
KU Field Station	na	na	0.082	na

* Design value for Kansas City Area

Table A-2. 8-Hour Ozone Exceedances in 2000, 2001 and 2002

	2000			2001			2002		
Site Name	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**
JFK	07/14	0.087	11				07/15	0.086	8
	07/16	0.087	10				09/07	0.086	10
	08/24	0.088	11						
	08/27	0.088	10						
KCI	07/16	0.090	11	08/04	0.087	10	07/15	0.092	11
	08/16	0.085	11	08/05	0.092	10	07/16	0.085	10
	08/24	0.090	10				08/09	0.085	11
	08/27	0.094	11				09/07	0.088	11
	09/02	0.093	10						
Liberty	06/08	0.085	9	07/17	0.088	10	07/07	0.085	9
	08/15	0.100	10	08/02	0.087	9	07/08	0.094	10
	08/24	0.087	11				08/05	0.102	10
	08/27	0.098	10				08/09	0.089	10
	08/30	0.088	10				09/07	0.087	9
	09/02	0.103	10						
	09/07	0.091	11						
RG South	08/15	0.090	10				09/07	0.088	9
	08/29	0.099	12						
	09/01	0.099	13						

	2000			2001			2002		
Site Name	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**	**Date**	**8-Hr Daily Max Value (ppm)**	**Time (hour)**
Watkins Mill	08/15	0.098	9	07/17	0.085	10	07/08	0.086	10
	08/27	0.087	10				08/05	0.091	10
	09/02	0.086	10				08/09	0.085	9
World of Fun	07/14	0.088	11						
	08/15	0.089	10						
	08/24	0.086	10						
	08/27	0.094	10						
	09/02	0.090	9						
Rocky Creek							07/06	0.089	10
							07/15	0.088	10
							07/16	0.086	10
							07/26	0.086	10
							07/30	0.089	10
							08/05	0.097	11
							08/09	0.091	11
							09/05	0.085	11
							09/06	0.091	10
							09/07	0.094	10

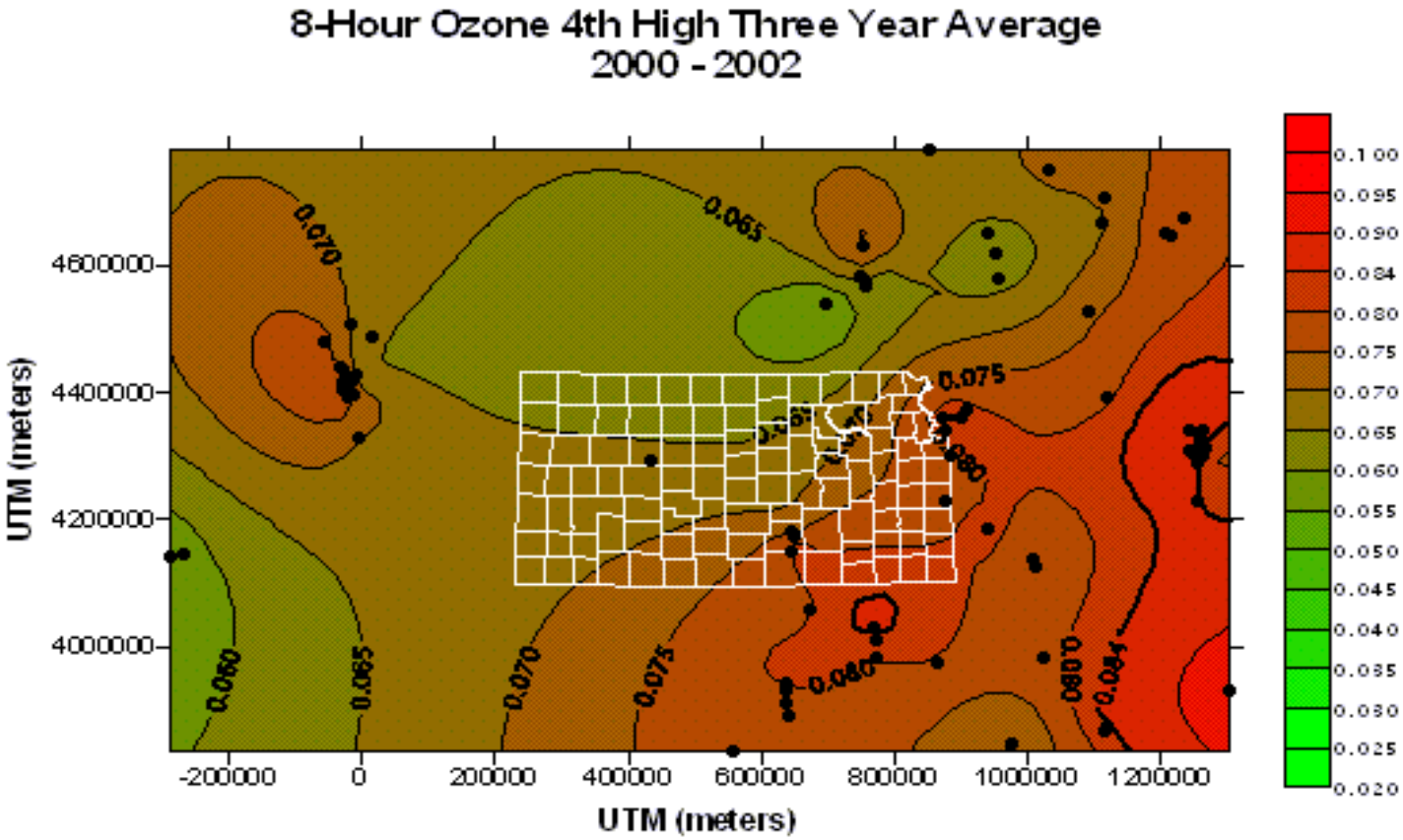


Figure A-1. Plot of 4th-Highest, 3-Year Average 8-Hour Ozone Concentrations Across Kansas (2000-2002)

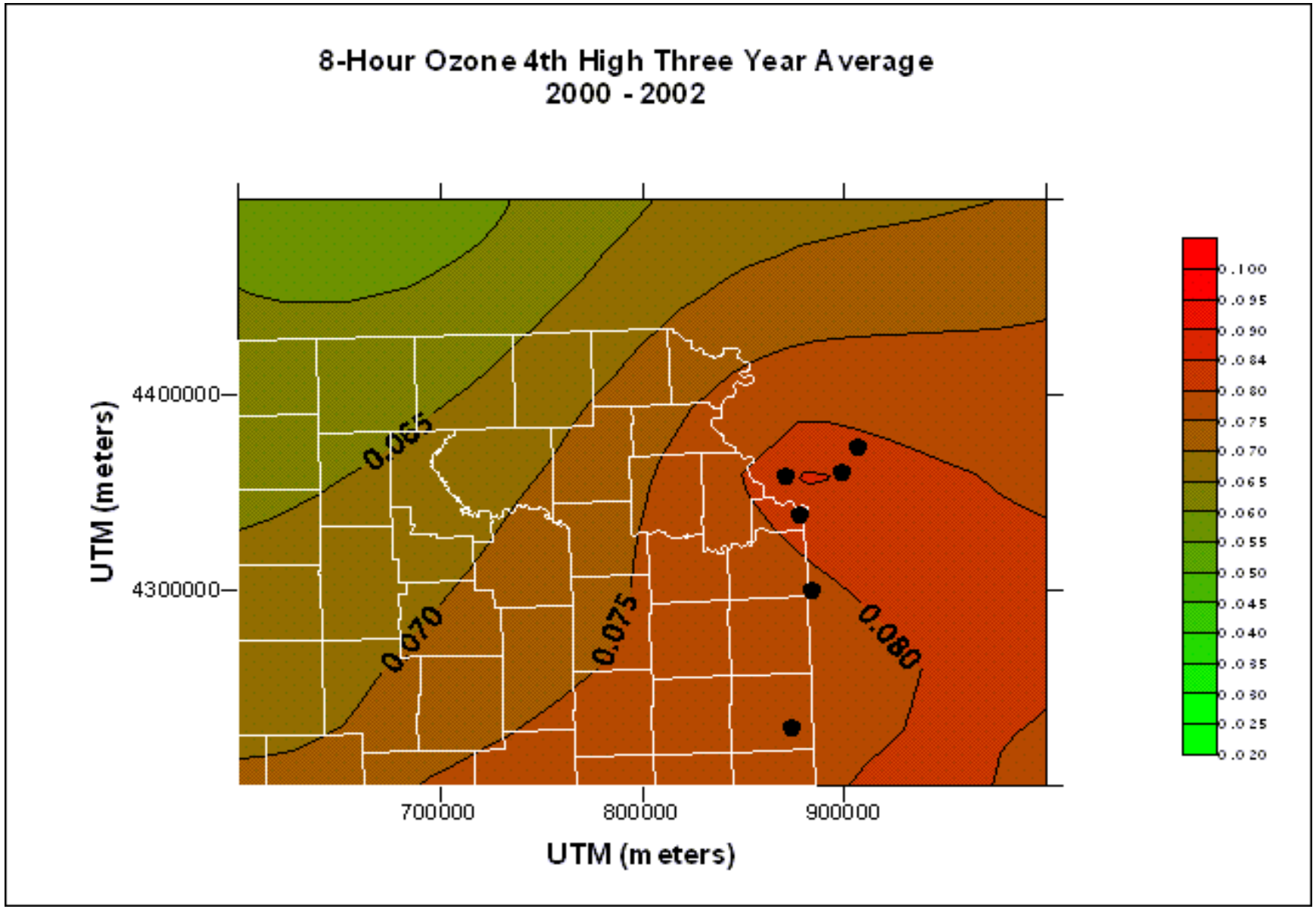


Figure A-2. Plot of 4th-Highest, 3-Year Average 8-Hour Ozone Concentrations in Kansas City Region (2000-2002)

APPENDIX B
Emissions Data

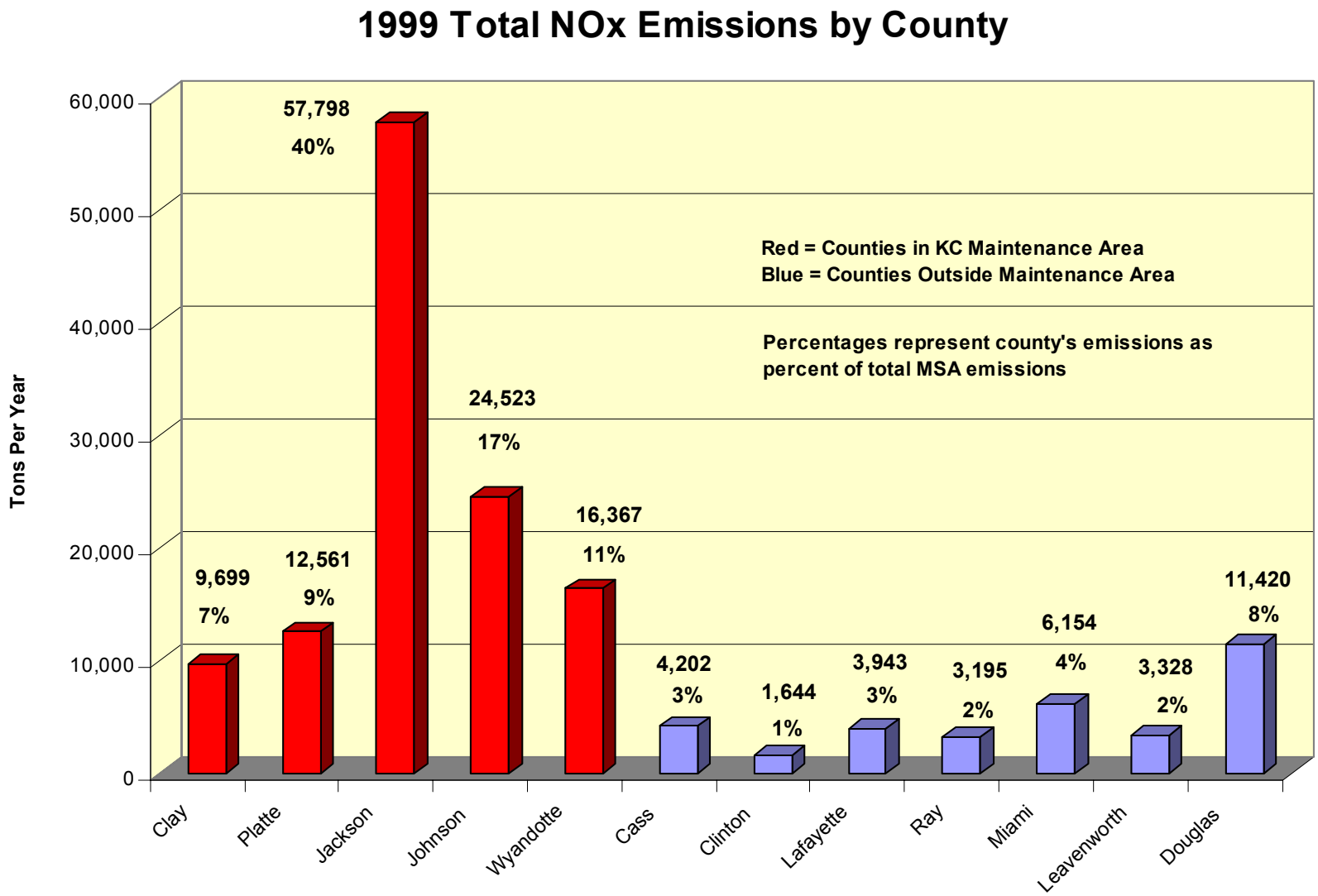
Table B-1. Summary of Annual NOx and VOC Emissions in Kansas City Area Counties

	1999 NOx Emissions (TPY)				NOx as % of MSA Emissions				1999 VOC Emissions (TPY)				VOC as % of MSA Emissions			
	POINT	AREA	MOBILE	TOTAL	POINT	AREA	MOBILE	TOTAL	POINT	AREA	MOBILE	TOTAL	POINT	AREA	MOBILE	TOTAL
KS MSA																
Johnson*	1,483.6	10,360.4	12,679.0	24,522.9	3.5	24.5	21.5	17.1	612.9	15,872.4	9,667.0	26,152.3	8.1	30.7	22.0	25.4
Leavenworth	59.3	1,178.1	2,090.6	3,328.0	0.1	2.8	3.5	2.3	273.4	1,917.4	1,290.9	3,481.6	3.6	3.7	2.9	3.4
Miami	2,012.4	3,163.6	977.7	6,153.7	4.8	7.5	1.7	4.3	142.2	1,056.6	516.2	1,715.0	1.9	2.0	1.2	1.7
Wyandotte*	7,543.6	3,674.5	5,149.0	16,367.1	17.9	8.7	8.7	11.4	2,801.4	4,752.4	4,133.8	11,687.6	37.2	9.2	9.4	11.3
MO MSA																
Cass	89.6	1,435.1	2,677.3	4,202.0	0.2	3.4	4.5	2.9	10.8	2,919.5	1,796.8	4,727.1	0.1	5.7	4.1	4.6
Clay*	594.3	3,209.0	5,895.8	9,699.1	1.4	7.6	10.0	6.8	2,235.3	4,440.0	4,450.1	11,125.4	29.7	8.6	10.1	10.8
Clinton	0.0	335.1	1,309.0	1,644.2	0.0	0.8	2.2	1.1	5.0	969.1	655.3	1,629.4	0.1	1.9	1.5	1.6
Jackson*	23,833.5	12,285.3	21,678.9	57,797.7	56.5	29.1	36.7	40.3	1,018.6	14,188.2	17,589.8	32,796.6	13.5	27.5	40.1	31.8
Lafayette	48.5	1,596.7	2,297.4	3,942.6	0.1	3.8	3.9	2.7	181.2	1,803.4	1,138.8	3,123.4	2.4	3.5	2.6	3.0
Platte*	6,512.5	2,767.9	3,280.5	12,560.9	15.4	6.6	5.6	8.8	243.2	2,458.9	2,044.0	4,746.1	3.2	4.8	4.7	4.6
Ray	3.7	2,206.5	985.0	3,195.3	0.0	5.2	1.7	2.2	14.6	1,290.6	581.4	1,886.6	0.2	2.5	1.3	1.8
Total Maintenance Area Emissions	39,967.5	32,297.1	48,683.1	120,947.7	94.8	76.5	82.5	84.3	6,911.3	41,712.0	37,884.7	86,508.0	91.7	80.7	86.4	83.9
Total MSA Emissions	42,180.9	42,212.2	59,020.2	143,413.3	100.0	100.0	100.0	100.0	7,538.5	51,668.6	43,864.0	103,071.1	100.0	100.0	100.0	100.0
Other KS Counties																
Douglas	7,251.1	1,914.1	2,255.0	11,420.2	17.2	4.5	3.8	8.0	123.3	3,081.9	1,628.5	4,833.7	1.6	6.0	3.7	4.7

NOTE: Area source emissions in this table include both area and offroad mobile source emissions.

* Counties in the Kansas City Maintenance Area

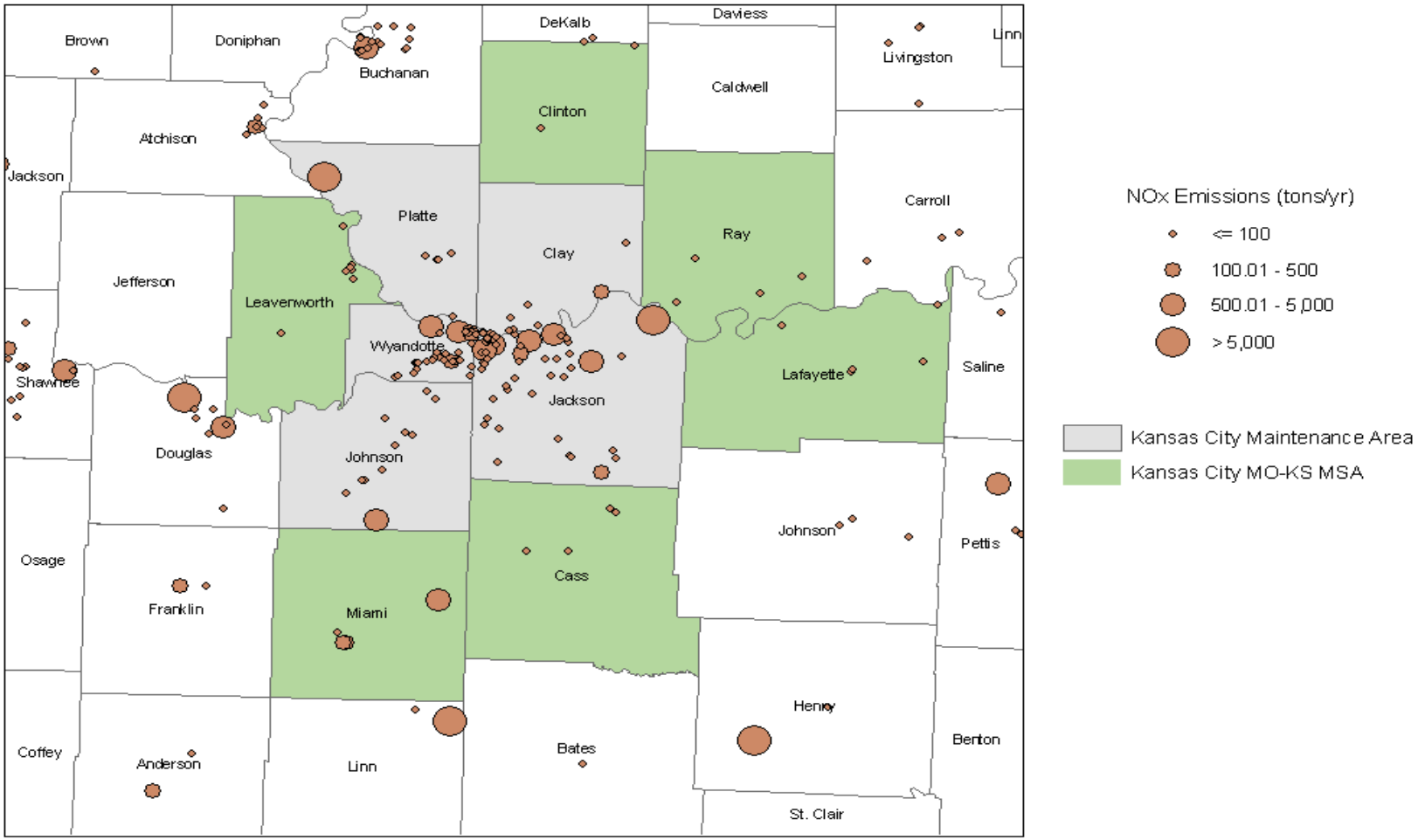
Sources: KS point - KDHE BAR, point source emissions database, 1999. MO point - 1999 NEI, Final v. 2. Area for KS counties in maintenance area - 1999 Kansas City Maintenance Area Inventory. Other KS area - 1999 NEI, Final v. 2. Area for MO counties - MDNR APCP, area source emissions database, 1999. Offroad and onroad mobile - 1999 NEI, Final v. 2.



Sources: KS point - KDHE BAR, point source emissions database, 1999. MO point - U.S. EPA, 1999 NEI, Final Version 2. Area for KS counties in KCMA - 1999 KC Maintenance Area Inv. MO area - MDNR Air Pollution Control Program, area source emissions database, 1999. All other - 1999 NEI, Final Version 2.

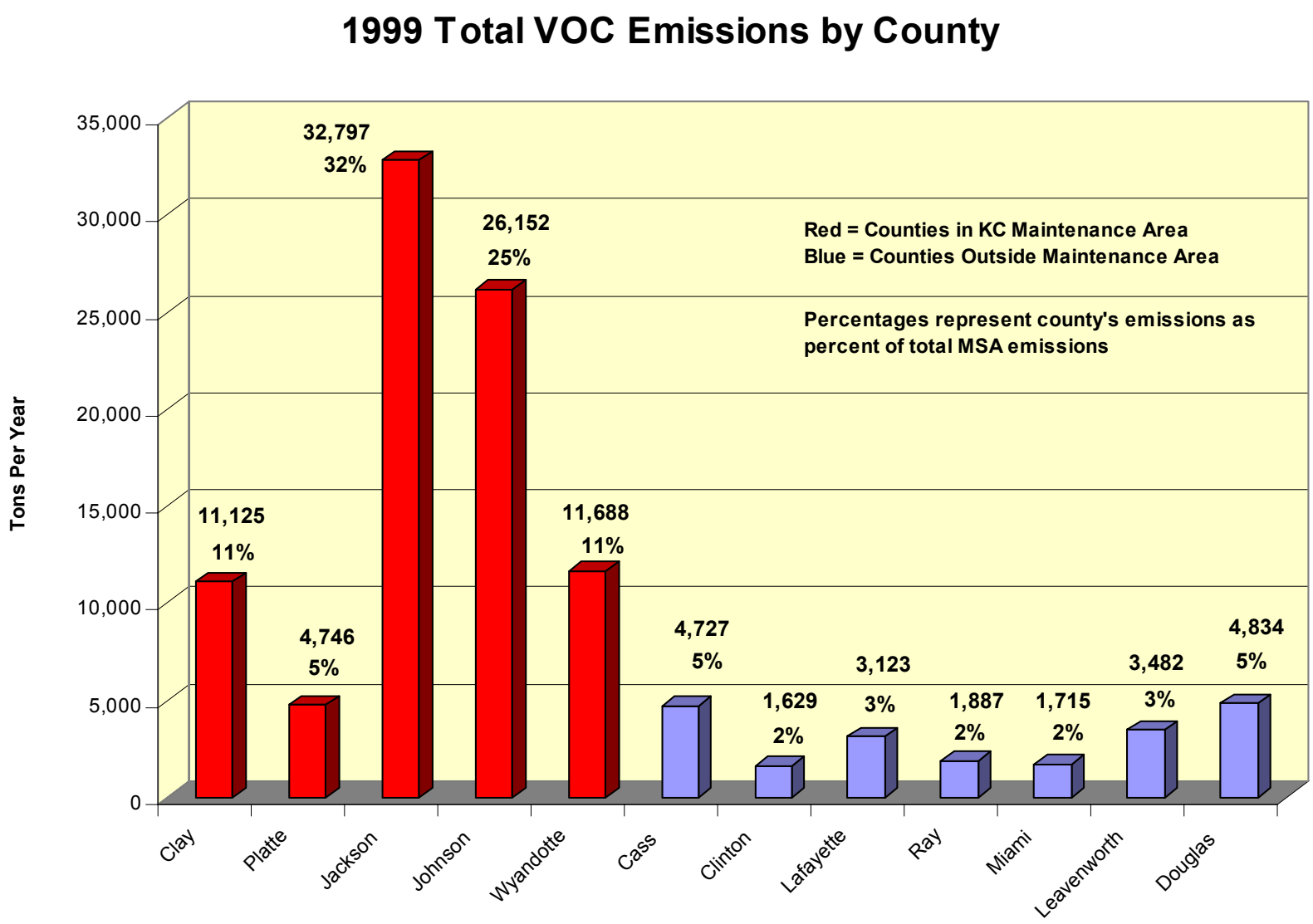
Figure B-1. 1999 Total NOx Emissions by County

1999 NOx Point Source Emissions



Sources: Kansas data from Kansas Dept. of Health and Environment, Bureau of Air and Radiation, point source emissions database, 1999. Missouri data from U.S. Environmental Protection Agency, 1999 National Emissions Inventory, Final Version 2.

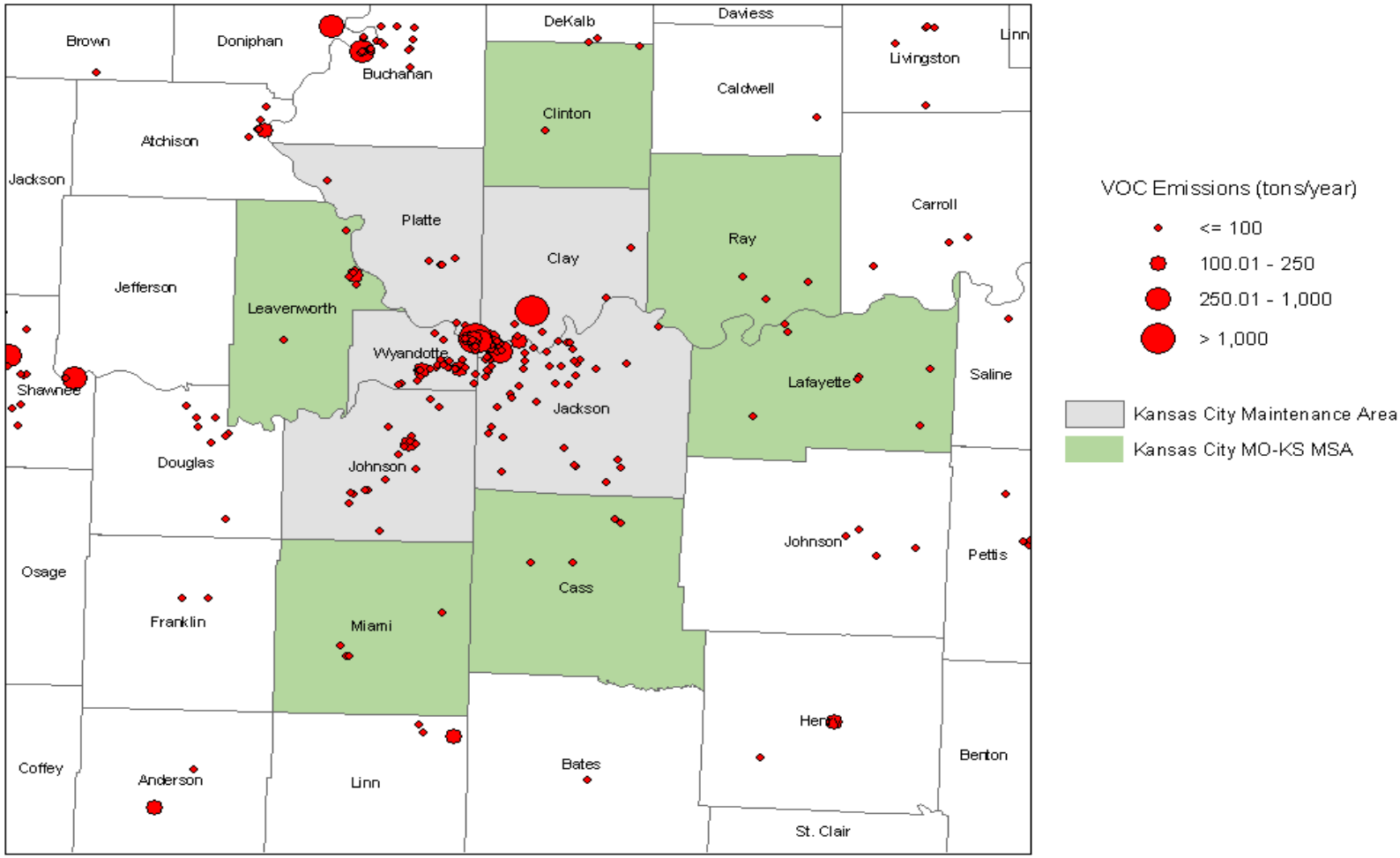
Figure B-2. 1999 NOx Point Source Emissions



Sources: KS point - KDHE BAR, point source emissions database, 1999. MO point - U.S. EPA, 1999 NEI, Final Version 2. Area for KS counties in KCMA - 1999 KC Maintenance Area Inv. MO area - MDNR Air Pollution Control Program, area source emissions database, 1999. All other - 1999 NEI, Final Version 2.

Figure B-3. 1999 Total VOC Emissions by County

1999 VOC Point Source Emissions



Sources: Kansas data from Kansas Dept. of Health and Environment, Bureau of Air and Radiation, point source emissions database, 1999. Missouri data from U.S. Environmental Protection Agency, 1999 National Emissions Inventory, Final Version 2.

Figure B-4. 1999 VOC Point Source Emissions

Table B-2. Kansas 1999 NOx and VOC Point Source Emissions by Facility

SIC Code & Description		Facility ID	Facility Name	NOx (TPY)	VOC (TPY)
JOHNSON COUNTY*					
2752	Commercial Printing Lithograph	0910039	VERTIS, INC.	0.0	33.1
2759	Commercial Printing, Nec	0910055	ROBBIE MANUFACTURING, INC.	0.0	132.9
		0910077	GRAPHIC TECHNOLOGY INC.	0.0	92.1
		0910085	DIMENSION GRAPHICS, INC.	0.6	17.1
2893	Printing Ink	0910083	NAZDAR	0.0	54.8
2951	Paving Mixtures and Blocks	0910095	HOLLAND CORPORATION, INC. -CEDAR RAPIDS	3.3	0.2
		0910133	ASPHALT SALES CO., INC.	13.6	6.1
2992	Lubricating Oils and Greases	0910014	EXXON CO., USA	7.3	0.2
3089	Plastics Products, Nec	0910010	MARLEY COOLING TOWER COMPANY	1.8	97.6
		0910151	INLAND MANUFACTURING	0.0	0.8
3211	Flat Glass	0910057	AFG INDUSTRIES, INC.	1,344.3	0.1
3469	Metal Stampings, Nec	0910084	VITA CRAFT CORPORATION	0.1	15.1
3531	Construction Machinery	0910129	DIAMANT BOART, INC.	0.1	8.9
3999	Manufacturing Industries, Nec	0910149	HOWELL MOULDINGS, INC.	0.0	68.8
4813	Telephone Communications, Except Radio	0910089	LUCENT TECHNOLOGIES, INC.	0.3	0.0
4911	Electric Services	0910065	GARDNER ENERGY CENTER	67.3	2.1
4922	Natural Gas Transmission	0910030	WILLIAMS GAS PIPELINES CENTRAL, INC.	43.8	4.1
4953	Refuse Systems	0910117	DEFFENBAUGH INDUSTRIES, INC.	0.0	22.1
4959	Sanitary Services, Nec	0910143	KANSAS WASTE WATER, INC.	0.1	0.0
5171	Petroleum Bulk Stations & Terminals	0910006	WILLIAMS PIPE LINE COMPANY	0.0	52.9
5961	Mail Order Houses	0910110	J.C. PENNEY CATALOG FULFILLMENT CENTER	0.8	0.0
7699	Repair Services, Nec	0910118	UNITED PARCEL SERVICES/WEST REGION TRAIL	0.0	4.1
JOHNSON COUNTY TOTALS				**1,483.6**	**612.9**
LEAVENWORTH COUNTY					
2679	Converted Paper Products, Nec	1030016	HALLMARK CARDS, INC.	1.0	35.7
2754	Commercial Printing, Gravure	1030013	HALLMARK CARDS, INC. (SELECT PRODUCTS)	3.0	227.8
4922	Natural Gas Transmission	1030011	WILLIAMS GAS PIPELINES CENTRAL, INC.	14.4	7.8

SIC Code & Description		Facility ID	Facility Name	NOx (TPY)	VOC (TPY)
8062	General Medical & Surgical Hospitals	1030020	DWIGHT D. EISENHOWER VA MEDICAL CENTER	9.8	0.4
8221	Colleges and Universities, Nec	1030018	ST. MARY COLLEGE (SISTERS OF CHARITY)	2.5	0.1
9223	Correctional Institutions	1030001	LANSING CORRECTIONAL FACILITY	2.1	0.2
9711	National Security	1030012	FORT LEAVENWORTH	26.5	1.5
LEAVENWORTH COUNTY TOTALS				**59.3**	**273.4**
MIAMI COUNTY					
4613	Refined Petroleum Pipe Lines	1210003	PHILLIPS PIPE LINE CO.-PAOLA TERMINAL	114.5	59.1
		1210017	WILLIAMS PIPE LINE COMPANY	160.9	12.0
4911	Electric Services	1210001	OSAWATOMIE-MUNICIPAL POWER PLANT	11.8	0.8
4922	Natural Gas Transmission	1210015	PANHANDLE EASTERN PIPE LINE COMPANY	1,725.1	70.3
MIAMI COUNTY TOTALS				**2,012.4**	**142.2**
WYANDOTTE COUNTY*					
1442	Construction Sand and Gravel	2090026	KAW VALLEY SAND AND GRAVEL	2.3	0.1
		2090094	HOLLIDAY SAND & GRAVEL COMPANY	0.9	0.0
2013	Sausages & Other Prepared Meat	2090021	SWIFT-ECKRICH, INC.	15.3	0.3
2048	Prepared Feeds Nec	2090044	LAND O' LAKES FARMLAND FEED, LLC	5.3	0.1
2052	Cookies and Crackers	2090077	KEEBLER COMPANY	7.9	155.3
2752	Commercial Printing Lithograph	2090115	GREYSTONE GRAPHICS	0.9	22.1
2819	Industrial Inorganic Chemicals	2090039	PQ CORPORATION (THE)	67.2	127.8
2841	Soap and Other Detergents	2090011	PROCTER & GAMBLE MANUFACTURING CO.	34.2	4.9
2843	Surface Active Agents	2090062	HARCROS CHEMICALS INC	12.1	26.6
2869	Industrial Organic Chemicals,Nec	2090076	REICHHOLD CHEMICALS, INC.	2.0	0.0
2891	Adhesives and Sealants	2090101	PERMATEX, INC.	0.2	10.3
2951	Paving Mixtures and Blocks	2090018	J.M. FAHEY CONSTRUCTION, CR ADM10040	2.6	0.1
		2090035	ASPHALT SALES CO., INC. (CMI-ST-400)	8.0	3.6
3086	Plastics Foam Products	2090212	CONTOUR PRODUCTS, INC.	3.7	0.2
3273	Ready-Mixed Concrete	2090038	RICH MIX PRODUCTS, INC.-KANSAS DIVISION	0.6	0.0

SIC Code & Description		Facility ID	Facility Name	NOx (TPY)	VOC (TPY)
3296	Mineral Wool	2090001	CERTAIN TEED CORPORATION	168.6	79.0
		2090010	OWENS CORNING	265.9	134.4
3443	Fabricated Plate Work (Boiler Shops)	2090106	COLUMBIAN STEEL TANK COMPANY	0.4	87.5
3462	Iron and Steel Forgings	2090009	GRIFFIN WHEEL COMPANY	42.4	20.0
3535	Conveyors and Conveying Equipment	2090199	DEARBORN MIDWEST CONVEYOR	0.0	29.1
		2090236	PREMIER CONVEYOR & MANUFACTURING CORP	0.0	2.6
3561	Pumps and Pumping Equipment	2090047	FAIRBANKS MORSE PUMP CORP.	0.5	19.1
3646	Commercial Lighting Fixtures	2090205	LSI MIDWEST LIGHTING, INC.	0.0	25.4
3711	Motor Vehicles and Car Bodies	2090046	GENERAL MOTORS CORP. FAIRFAX PLANT	44.9	1,333.2
		2090229	GARSITE, INC.	0.1	8.9
3714	Motor Vehicle Parts & Accessories	2090190	MERIDIAN AUTOMOTIVE SYSTEMS, INC.	4.6	134.7
4911	Electric Services	2090008	BOARD OF PUBLIC UTILITIES - NEARMAN	2,990.4	24.5
		2090048	BOARD OF PUBLIC UTILITIES - QUINDARO	3,630.6	41.7
		2090049	BOARD OF PUBLIC UTILITIES - KAW	165.3	2.1
4953	Refuse Systems	2090003	ALLIED WASTE	14.0	36.3
		2090194	STERICYCLE, INC.	8.6	1.3
5169	Chemicals and Allied Products, Nec	2090202	BARTON SOLVENTS, INC.	0.0	7.9
5171	Petroleum Bulk Stations & Terminals	2090060	WILLIAMS PIPE LINE COMPANY	6.2	309.6
		2090063	SINCLAIR PIPELINE COMPANY	0.0	79.4
		2090064	WILLIAMS PIPE LINE COMPANY	0.0	0.0
		2090075	PHILLIPS PIPE LINE CO.-K.C. TERMINAL	10.9	72.8
8062	General Medical & Surgical Hospitals	2090169	KANSAS UNIVERSITY MEDICAL CENTER	20.6	0.4
		2090234	BETHANY MEDICAL CENTER	6.5	0.1
WYANDOTTE COUNTY TOTALS				**7,543.6**	**2,801.4**
DOUGLAS COUNTY					
2771	Greeting Card Publishing	0450004	HALLMARK CARDS, INC.	1.4	31.7
2819	Industrial Inorganic Chemicals	0450013	ASTARIS	30.3	1.7
2873	Nitrogenous Fertilizers	0450012	FARMLAND INDUSTRIES, INC.	1,491.6	6.4
2951	Paving Mixtures and Blocks	0450005	ASPHALT SALES OF LAWRENCE, LLC	3.1	1.4
3273	Ready-Mixed Concrete	0450047	LRM INDUSTRIES, INC.	2.3	0.1

SIC Code & Description		Facility ID	Facility Name	NOx (TPY)	VOC (TPY)
3497	Metal Foil and Leaf	0450006	API FOILS	2.2	37.8
4911	Electric Services	0450011	BALDWIN CITY-MUNICIPAL POWER PLANT	34.3	1.8
		0450014	WESTERN RESOURCES, INC.	5,655.9	41.5
8221	Colleges and Universities, Nec	0450002	UNIVERSITY OF KANSAS	30.1	1.1
DOUGLAS COUNTY TOTALS				**7,251.1**	**123.3**

* Counties in the Kansas City Maintenance Area

Source: KDHE Bureau of Air and Radiation, point source emissions database, 1999.

Table B-3. Missouri 1999 NOx and VOC Point Source Emissions by Facility

SIC Code & Description		FACILITY ID	FACILITY NAME	NOx (TPY)	VOC (TPY)
CASS COUNTY					
1422	Crushed and Broken Limestone	0370007	LIMPUS QUARRIES INC	24.6	2.0
2435	Hardwood Veneer and Plywood	0370025	PLEASANT HILL VENEER CORP	1.8	6.9
2951	Paving Mixtures and Blocks	0370032	APAC - MISSOURI INC	8.4	1.4
4911	Electric Services	0370003	UTILICORP UNITED INC	54.5	0.3
4922	Natural Gas Transmission	0370048	WILLIAMS GAS PIPELINES - CENTRAL	0.3	0.3
CASS COUNTY TOTALS				**89.6**	**10.8**
CLAY COUNTY*					
2041	Flour & Other Grain Mill Prod	0470003	CON AGRA FLOUR MILLING CO	0.9	0.1
		0470009	ARCHER DANIELS MIDLAND CO	0.6	0.0
2046	Wet Corn Milling	0470002	NATIONAL STARCH & CHEMICAL CO	47.8	6.4
2075	Soybean Oil Mills	0470042	ADM PROCESSING	24.1	307.0
2651	Folding Paperboard Boxes	0470011	JEFFERSON SMURFIT CORP	0.4	13.3
2752	Commercial Printing Lithograph	0470032	HENRY WURST INC	2.1	25.3
		0470033	MIDLAND LITHOGRAPHY CO	0.5	35.3
2771	Greeting Card Publishing	0470059	HALLMARK CARDS INC	1.3	0.1
2851	Paints and Allied Products	0470012	COOK COMPOSITES AND POLYMERS CO	5.1	12.7
		0470040	DAVIS PAINT CO	0.2	16.7
		0470075	TNEMEC COMPANY INC	0.2	26.3
		0470079	CAMPBELL, EARL MFG CO	0.0	9.9
2951	Paving Mixtures and Blocks	0472219	SUPERIOR ASPHALT COMPANY INC	6.7	0.3
2992	Lubricating Oils and Greases	0470052	JESCO RESOURCES INC	0.4	3.1
3089	Plastics Products, Nec	0470148	STAR BOARDS, INC.	0.1	4.5
3646	Commercial Lighting Fixtures	0470120	DEVINE DESIGN	1.0	2.2
3711	Motor Vehicles and Car Bodies	0470019	FORD MOTOR CO	94.5	1,742.8
3714	Motor Vehicle Parts & Accessories	0470126	AMERICAN RAILCAR IND - FLEET SERVICES	3.6	22.3
4911	Electric Services	0470096	INDEPENDENCE POWER AND LIGHT	384.3	0.5
5153	Grain	0470027	CARGILL INC	0.1	0.0

SIC Code & Description		FACILITY ID	FACILITY NAME	NOx (TPY)	VOC (TPY)
9999	Nonclassifiable Establishments	0470007	U. S. GYPSUM CO	16.7	0.9
		0470046	HCI CHEMTECH DISTRIBUTION INC	3.6	0.2
		0470070	GILMOUR HOSE COMPANY	0.2	5.3
CLAY COUNTY TOTALS				**594.3**	**2,235.3**
CLINTON COUNTY					
5153	Grain	0490011	CAMERON COOP ELEVATOR ASSN	0.0	3.5
5172	Petroleum Products, Nec	0490016	UNITED COOPERATIVE INC	0.0	1.5
CLINTON COUNTY TOTALS				**0.0**	**5.0**
JACKSON COUNTY*					
1422	Crushed and Broken Limestone	0950048	LIMPUS QUARRIES INC	15.4	0.8
2035	Pickles Sauces and Salad Dress	0950178	UNILEVER BESTFOODS NORTH AMERICA	6.2	2.5
2048	Prepared Feeds Nec	0950057	PFIZER INC	2.3	0.3
2075	Soybean Oil Mills	0952001	CARGILL INC	30.2	271.7
2095	Roasted Coffee	0950017	FOLGERS COFFEE CO	42.6	41.7
2499	Wood Products, Nec	0950196	SEXTON METALCRAFT INC	0.5	26.6
2652	Set-Up Paperboard Boxes	0950197	BURD & FLETCHER	0.0	48.2
2751	Commercial Printing Letterpress	0950067	TENSION ENVELOPE CORPORATION	1.7	25.1
2771	Greeting Card Publishing	0950114	HALLMARK CARDS	5.5	60.5
2951	Paving Mixtures and Blocks	0950003	J. M. FAHEY CONSTRUCTION COMPANY	5.1	1.4
		0950037	VANCE BROTHERS INC	19.8	3.5
		0950061	APAC MISSOURI INC	3.7	0.0
		0950064	KOCH ASPHALT	1.9	4.6
		0950192	BOWEN CONSTRUCTION CO	4.2	0.2
3086	Plastics Foam Products	0952058	COOK BROTHERS INSULATION INC	0.0	0.2
3089	Plastics Products, Nec	0950244	TIFFANY MARBLE, INC	0.2	3.2
3241	Cement, Hydraulic	0950030	LAFARGE CORPORATION	1,190.3	26.9
3312	Blast Furnaces and Steel Mills	0950004	GST STEEL CO	282.2	69.6
3321	Gray Iron Foundries	0950012	CLAY & BAILEY MFG CO	1.3	7.7
3411	Metal Cans	0950175	BALL CORPORATION	8.5	118.3
3441	Fabricated Structural Metal	0950040	HAVENS STEEL CO	0.0	19.2

SIC Code & Description		FACILITY ID	FACILITY NAME	NOx (TPY)	VOC (TPY)
3479	Metal Coating and Allied Services,Nec	0952045	HOLLAND NAMEPLATE & ENGRAVING CO	0.1	11.5
3482	Small Arms Ammunition	0950046	VALENTEC WELLS LLC	49.1	22.8
3647	Vehicular Lighting Equipment	0950075	PETERSON MFG CO	0.3	3.1
3674	Semiconductors & Related Devices	0956020	FABTECH INC	0.0	3.4
3678	Electronic Connectors	0950078	TOWNSEND SUMMIT LLC	8.4	0.5
3679	Electronic Components, Nec	0950005	U. S. DEPT OF ENERGY	40.5	8.7
3713	Truck and Bus Bodies	0950191	AERO TRANSPORTATION PRODUCTS INC	0.0	12.4
4911	Electric Services	0950021	TRIGEN ENERGY CORPORATION	504.1	2.3
		0950022	KANSAS CITY POWER & LIGHT CO - HAWTHORN	574.4	28.8
		0950023	KANSAS CITY POWER & LIGHT CO - NORTHEAST	784.4	20.3
		0950031	MISSOURI PUBLIC SERVICE CO - SIBLEY	18,862.8	86.1
		0950050	INDEPENDENCE POWER AND LIGHT - BLUE	663.1	2.5
		0950139	UTILICORP UNITED INC - GREENWOOD	446.2	1.8
		0950222	INDEPENDENCE POWER AND LIGHT	20.1	0.5
		0950223	INDEPENDENCE POWER AND LIGHT	44.2	0.1
		0950224	INDEPENDENCE POWER AND LIGHT	23.1	0.6
		0950274	BARBER & SONS ELECTRIC GENERATION	83.2	2.6
4953	Refuse Systems	0950039	BLUE RIVER TREATMENT PLANT	44.2	11.1
		0950267	COURTNEY RIDGE RECYCLING & DISPOSAL	0.0	5.8
		0950273	RUMBLE RECYCLING AND DISPOSAL	24.6	9.1
		0952101	ALLIED WASTE INDUSTRIES	5.7	11.9
5171	Petroleum Bulk Stations & Terminals	0950002	AMOCO OIL CO	0.0	37.0
7011	Hotels and Motels	0952007	CROWN CENTER REDEVELOPMENT	12.8	0.6
8062	General Medical & Surgical Hospitals	0950062	MEDICAL CENTER OF INDEPENDENCE	1.5	0.1
		0950066	INDEPENDENCE REGIONAL HEALTH CENTER	3.1	1.6
		0952054	RESEARCH MEDICAL CENTER	9.0	0.2
		0952088	TRINITY LUTHERAN HOSPITAL	7.2	0.2
9999	Nonclassifiable Establishments	0952196	CHEMCENTRAL/KANSAS CITY	0.0	1.1
JACKSON COUNTY TOTALS				**23,833.5**	**1,018.6**

SIC Code & Description		FACILITY ID	FACILITY NAME	NOx (TPY)	VOC (TPY)
LAFAYETTE COUNTY					
2048	Prepared Feeds Nec	1070012	MID-MISSOURI COOPERATIVE - ALMA PLANT	0.1	5.8
		1070013	MID-MISSOURI COOPERATIVE - MID-MISSOURI	0.0	12.1
2499	Wood Products, Nec	1070029	S & K INDUSTRIES INC	0.0	22.0
2511	Wood Household Furniture	1070004	S & K INDUSTRIES INC	0.6	33.4
2821	Plastics Materials and Resins	1070010	WINCUP	7.0	79.2
3089	Plastics Products, Nec	1070037	KITCO, INC.	0.0	19.8
4911	Electric Services	1070038	HIGGINSVILLE MUNICIPAL POWER FACILITY	40.7	9.0
5153	Grain	1070050	BARTLETT & COMPANY GRAIN	0.1	0.0
LAFAYETTE COUNTY TOTALS				**48.5**	**181.2**
PLATTE COUNTY*					
2752	Commercial Printing Lithograph	1650026	LIFETOUCH PUBLICATIONS	0.0	21.8
3751	Motorcycles Bicycles & Parts	1652415	HARLEY DAVIDSON MOTOR CO	5.3	32.2
4581	Airports, Flying Fields, and Services	1652404	KCI AIRPORT - KCMO AVIATION DEPT	7.9	4.0
4582	Airports and Flying Fields	1650005	T.W.A. OVERHAUL OPERATIONS	49.6	25.1
4911	Electric Services	1650007	KANSAS CITY POWER & LIGHT CO - IATAN	6,429.8	81.4
		1650009	KCI ENERGY CNTR	15.5	0.0
5171	Petroleum Bulk Stations & Terminals	1650015	CONOCO INC	4.5	78.6
PLATTE COUNTY TOTALS				**6,512.5**	**243.2**
RAY COUNTY					
1422	Crushed and Broken Limestone	1770002	HUNT MIDWEST MINING/GREEN QUARRIES	0.6	0.0
3341	Secondary Nonferrous Metals	1770006	GRANULES CORPORATION	2.7	8.1
5191	Farm Supplies	1770004	ORRICK FARM SERVICE	0.2	0.0
		1770021	RAY-CARROLL COUNTY GRAIN GROWERS INC	0.2	0.0
5541	Gasoline Service Stations	1770033	RAY-CARROLL CO GRAIN GRWS INC	0.0	6.5
RAY COUNTY TOTALS				**3.7**	**14.6**

* Counties in the Kansas City Maintenance Area
Source: U.S. EPA, 1999 NEI, Final Version 2.

APPENDIX C
Meteorological Information

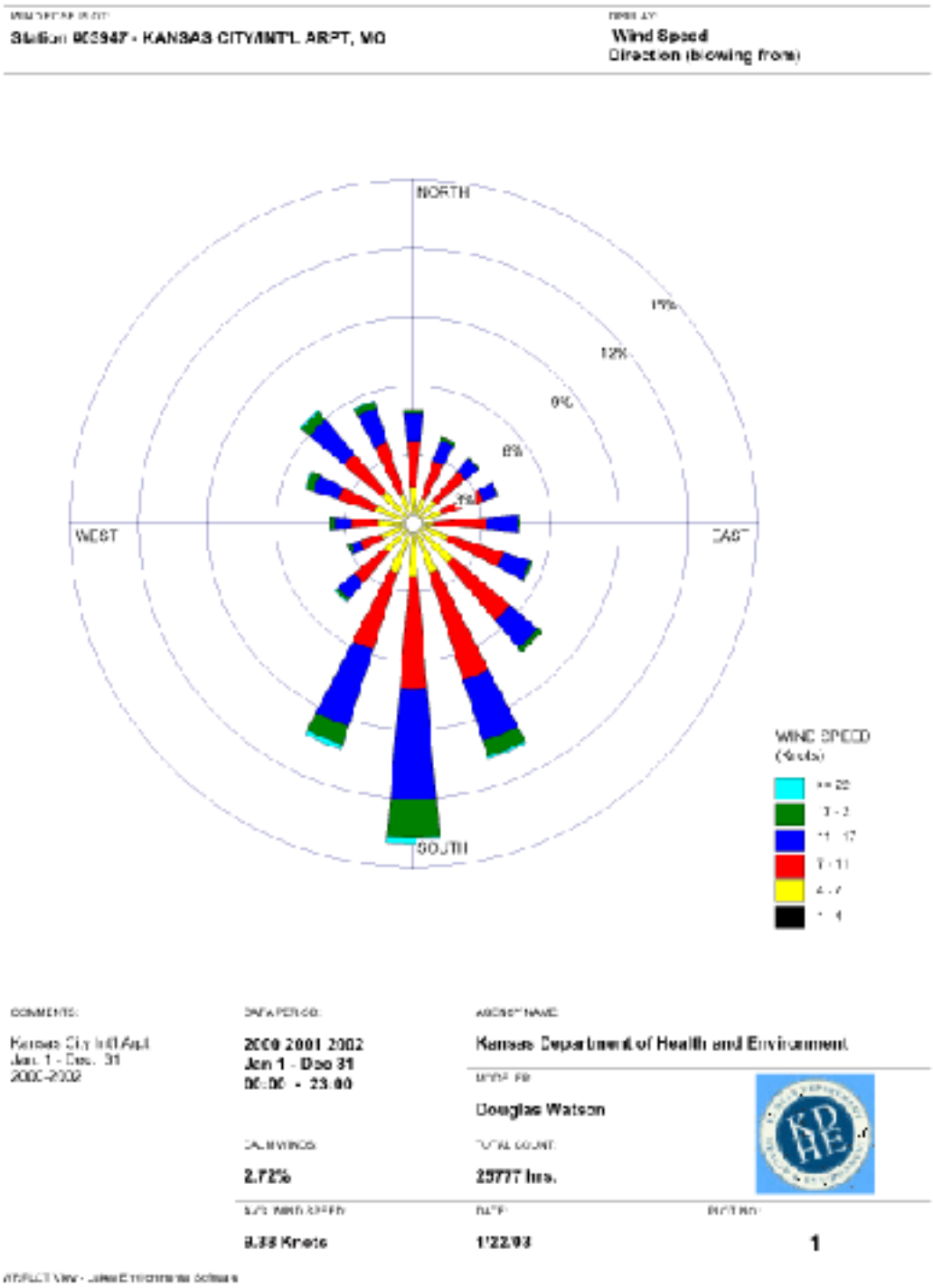


Figure C-1. KCI Airport Wind Rose - (Jan. - Dec., 2000-2002)

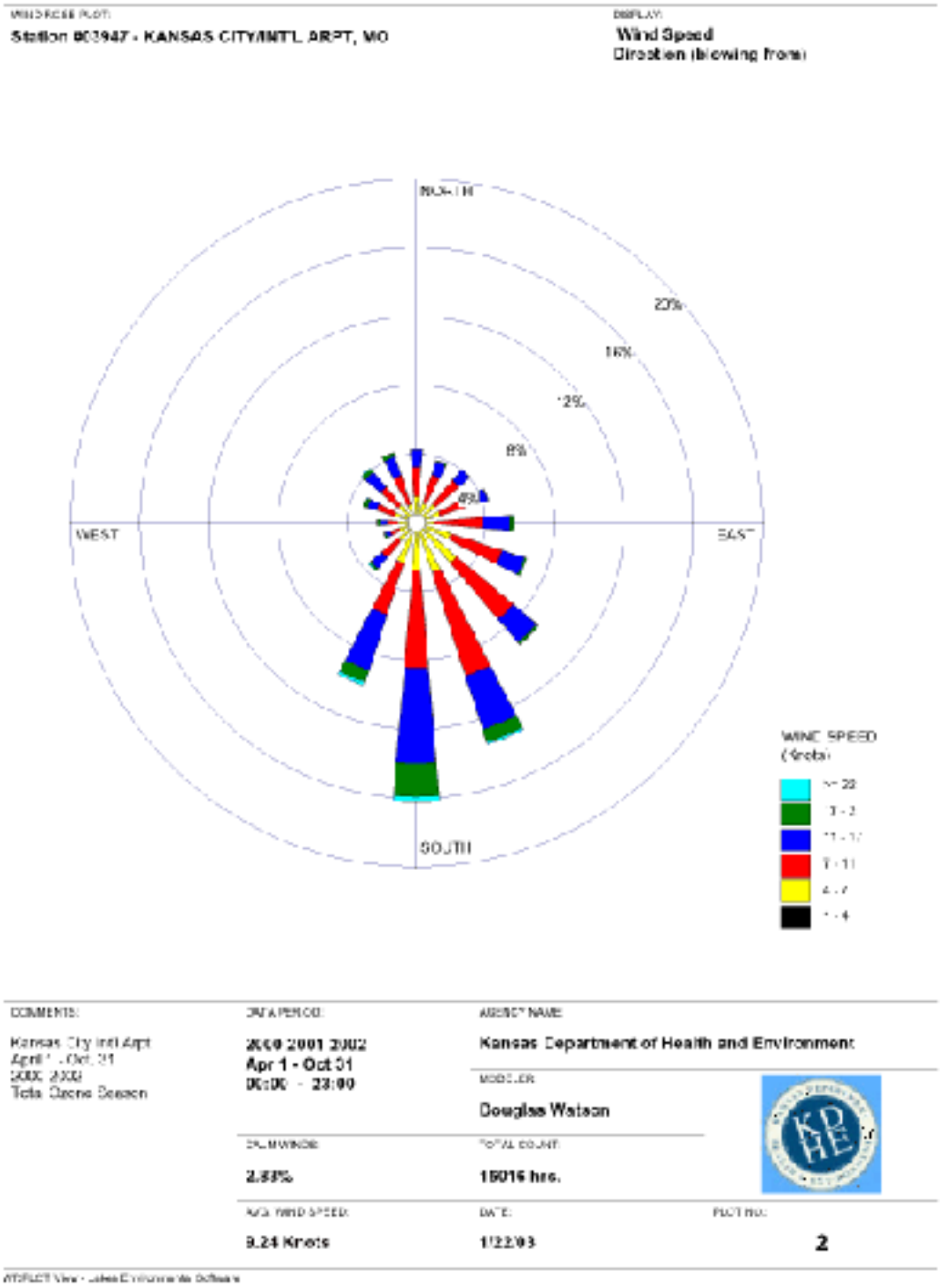


Figure C-2. KCI Airport Ozone Season Wind Rose (Apr. 1 - Oct. 31, 2000-2002)

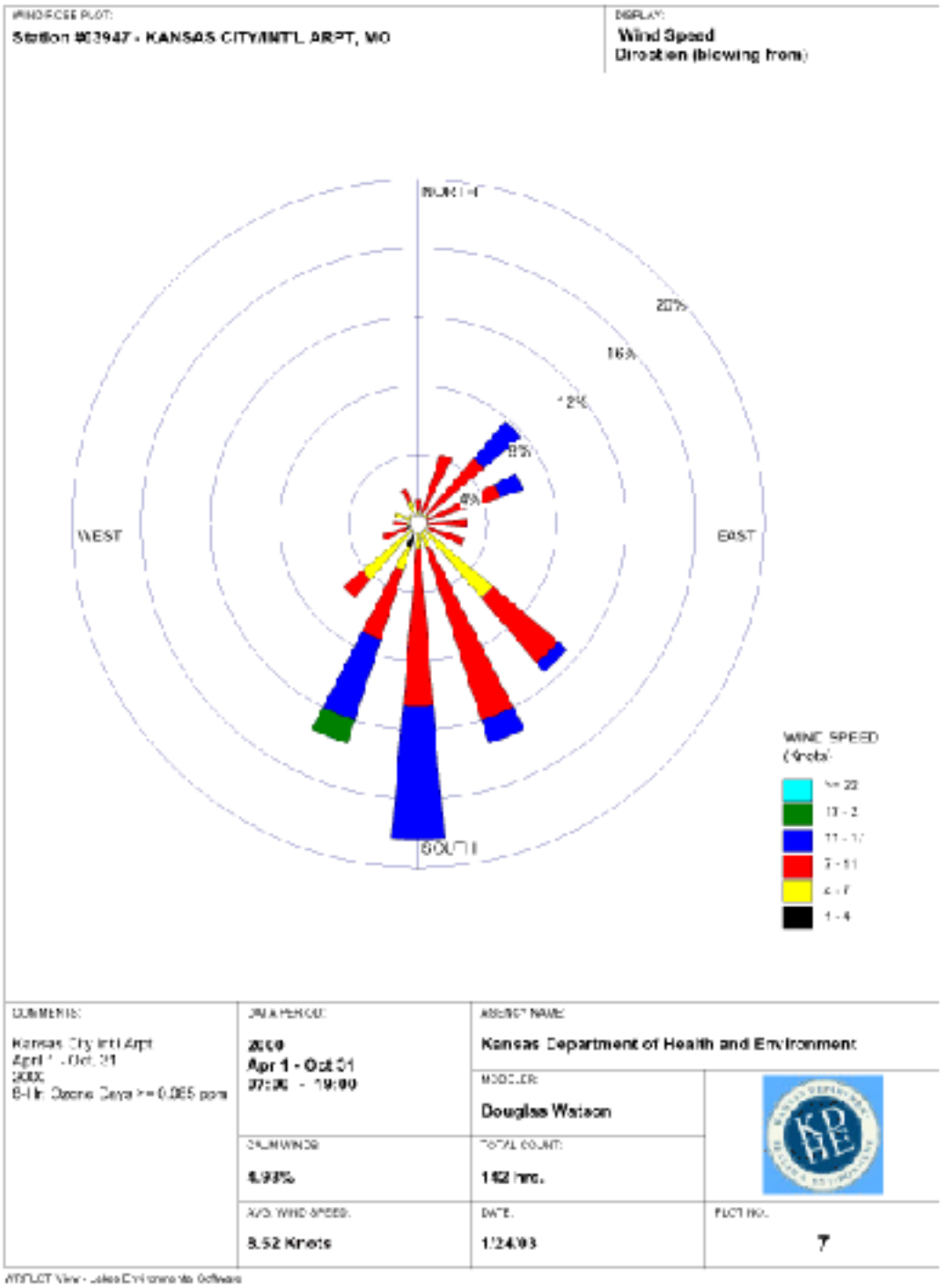


Figure C-3 KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2000

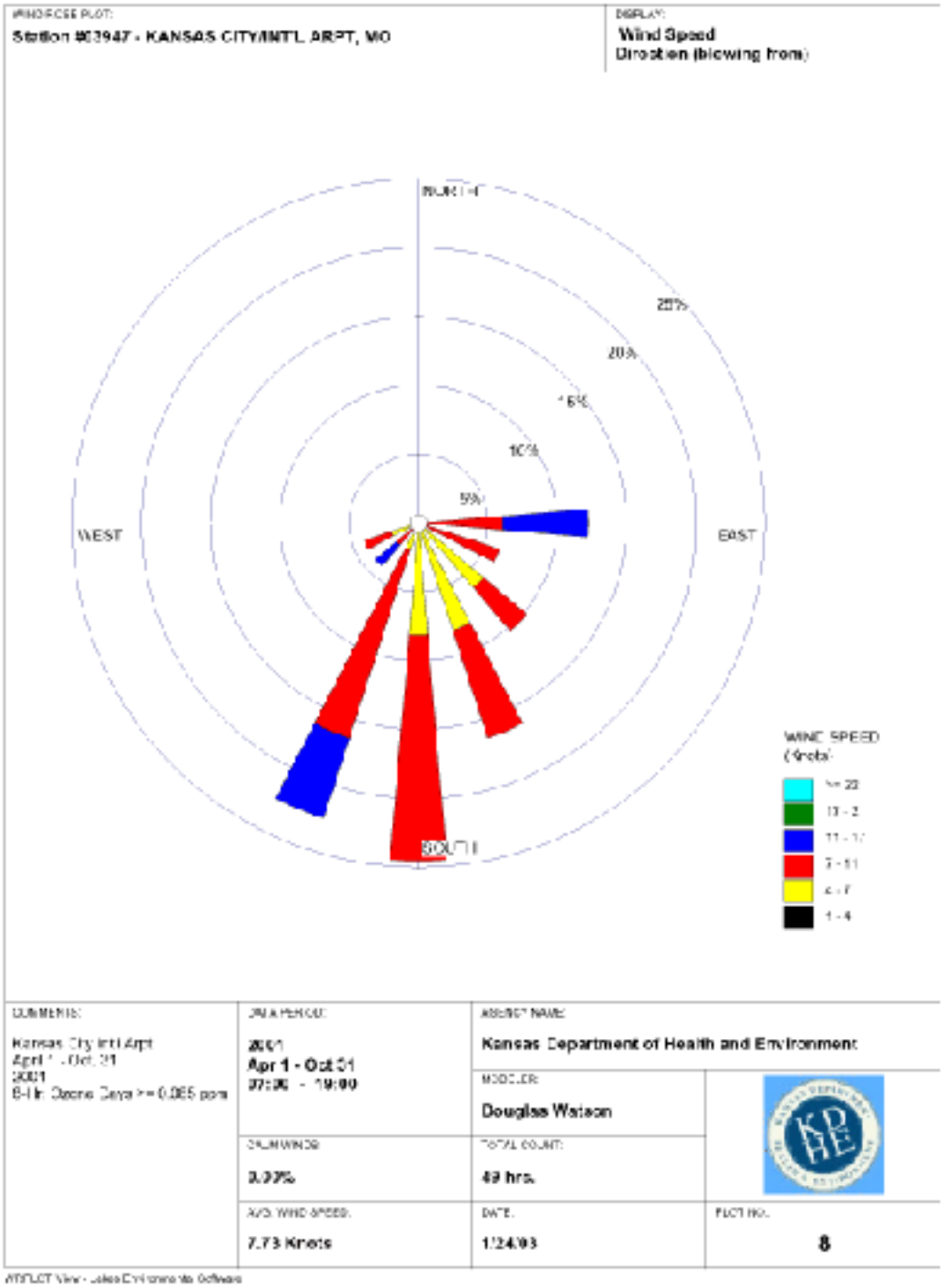


Figure C-4. KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2001

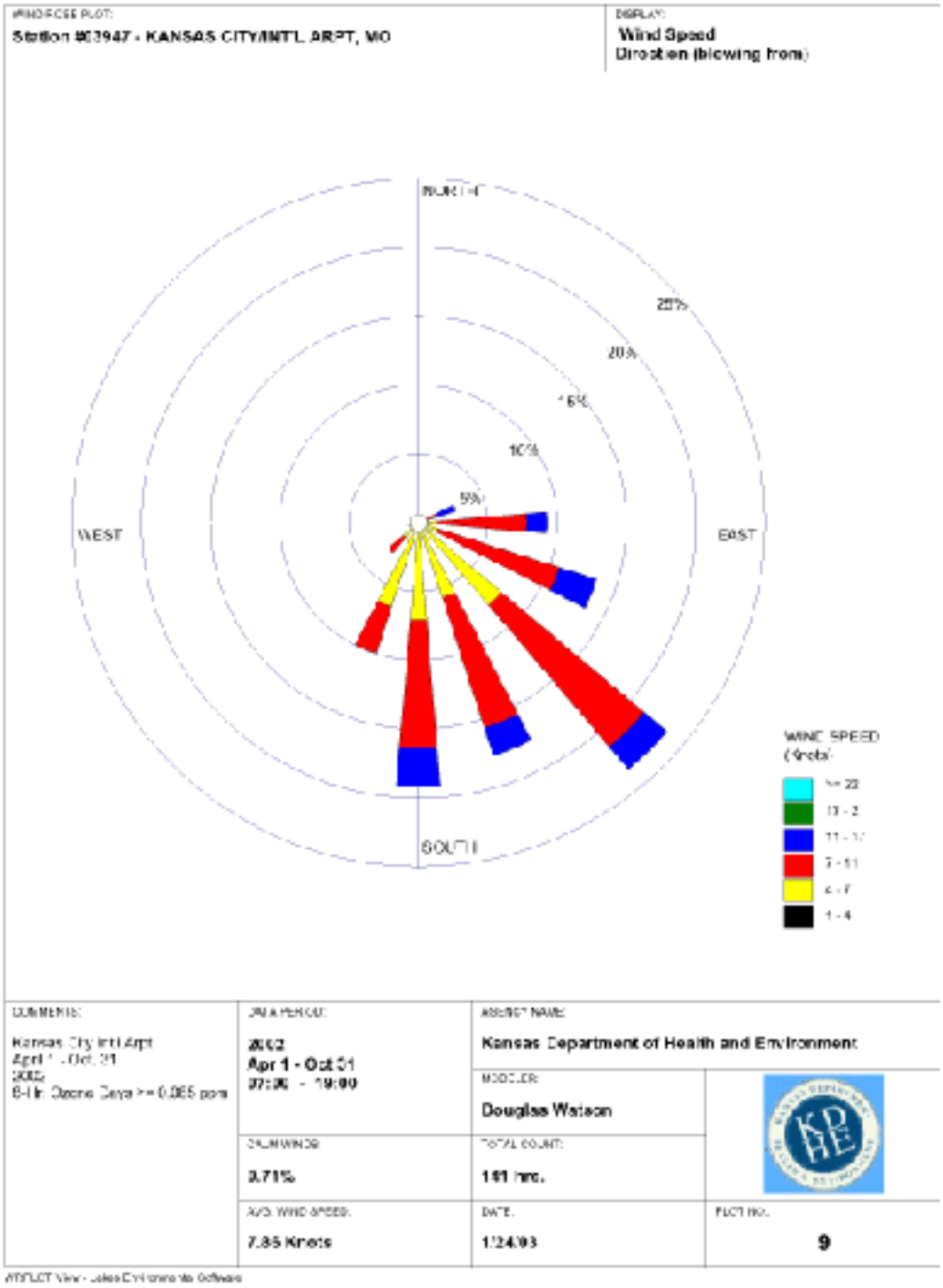
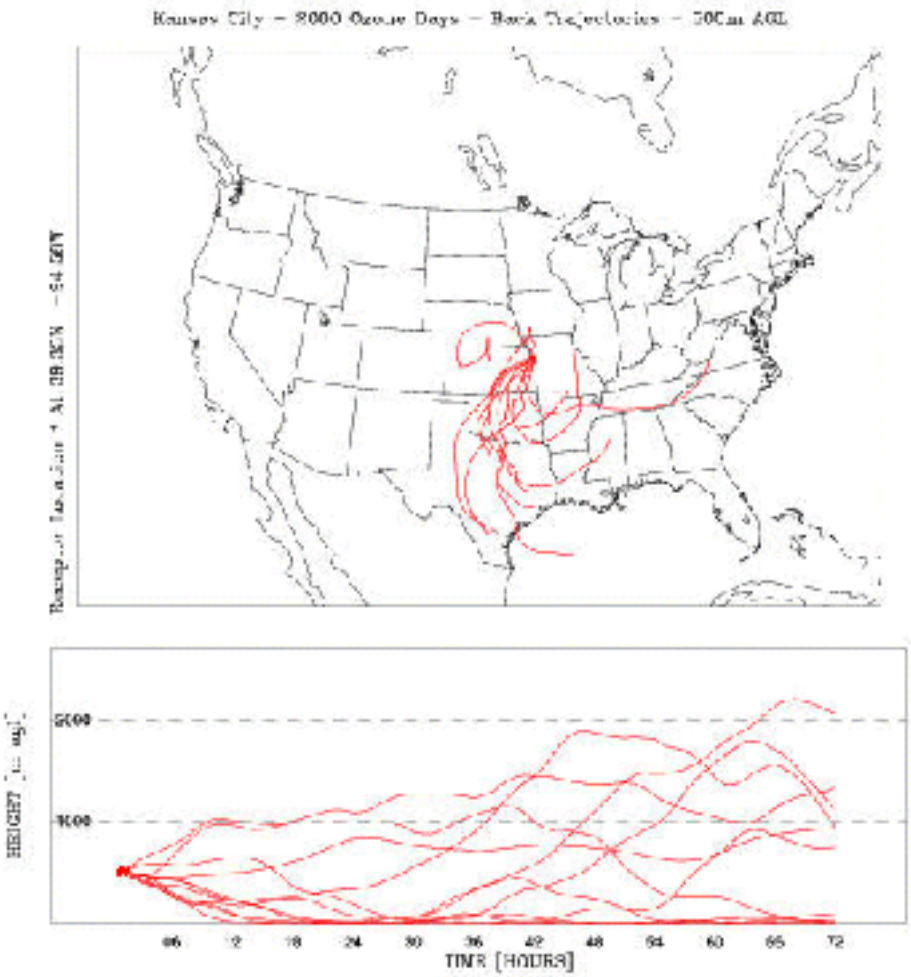


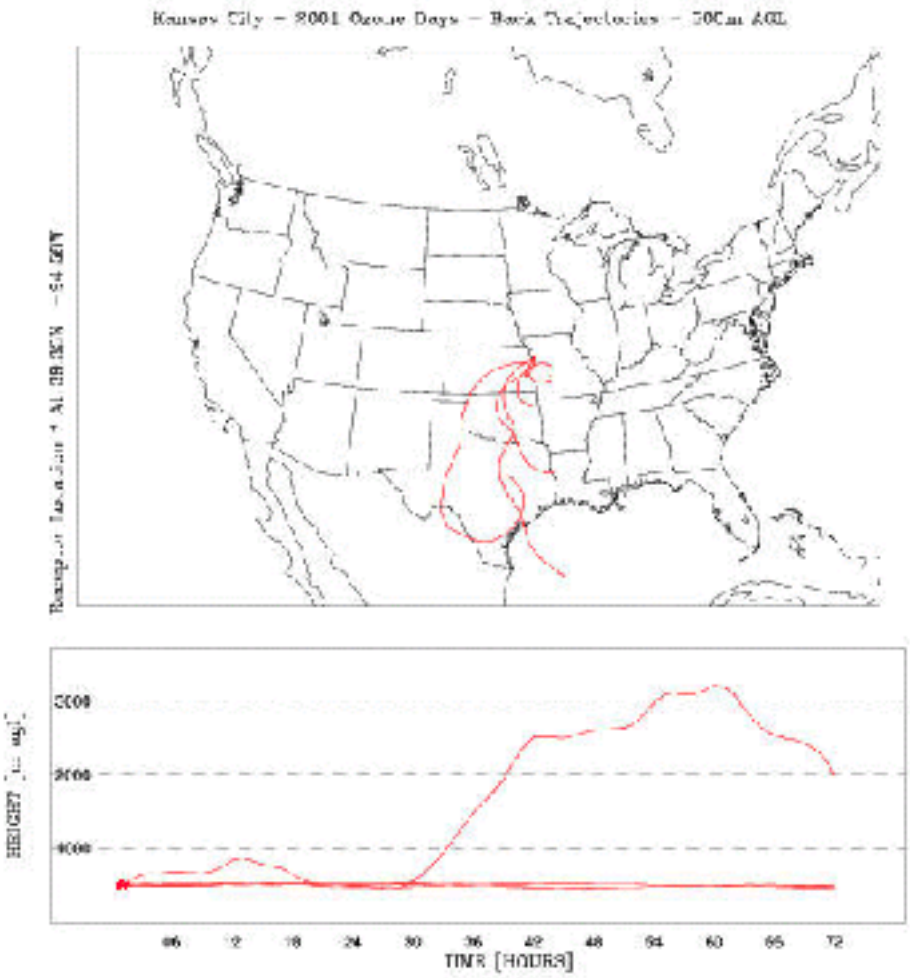
Figure C-5. KCI Airport 8-Hr. Ozone Exceedance Days Wind Rose, 2002



The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication.

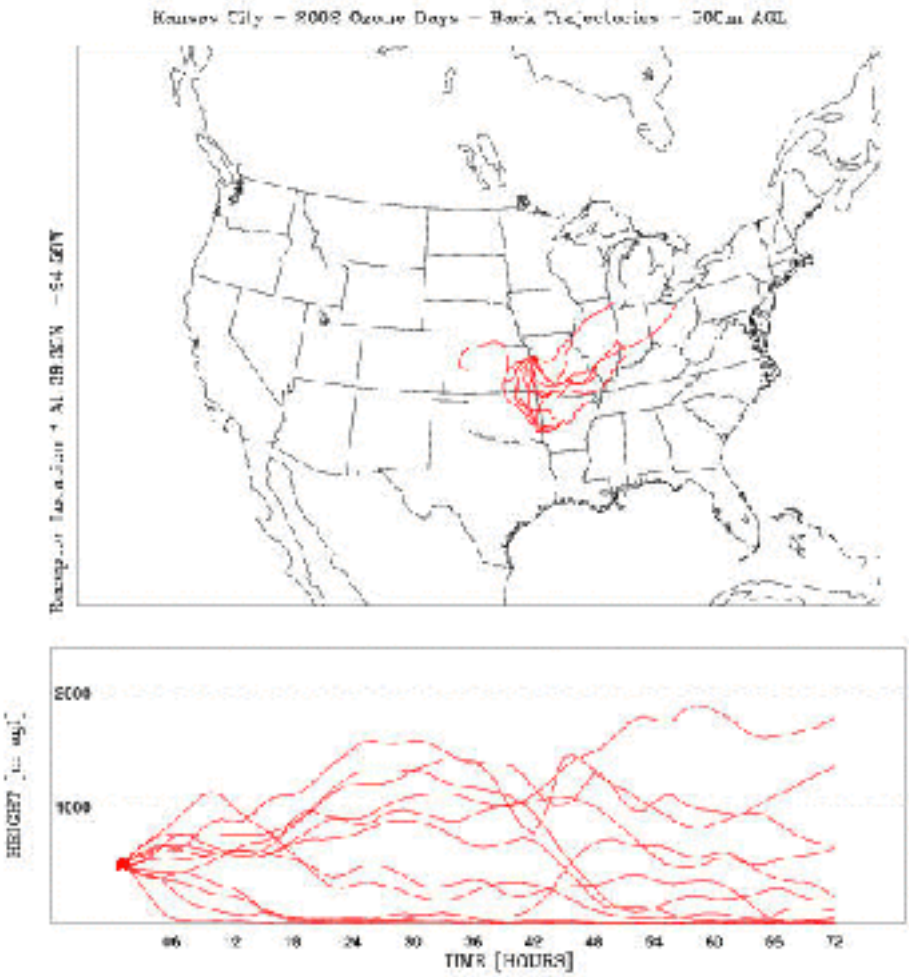
Also thanks goes to Brad Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-6. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2000



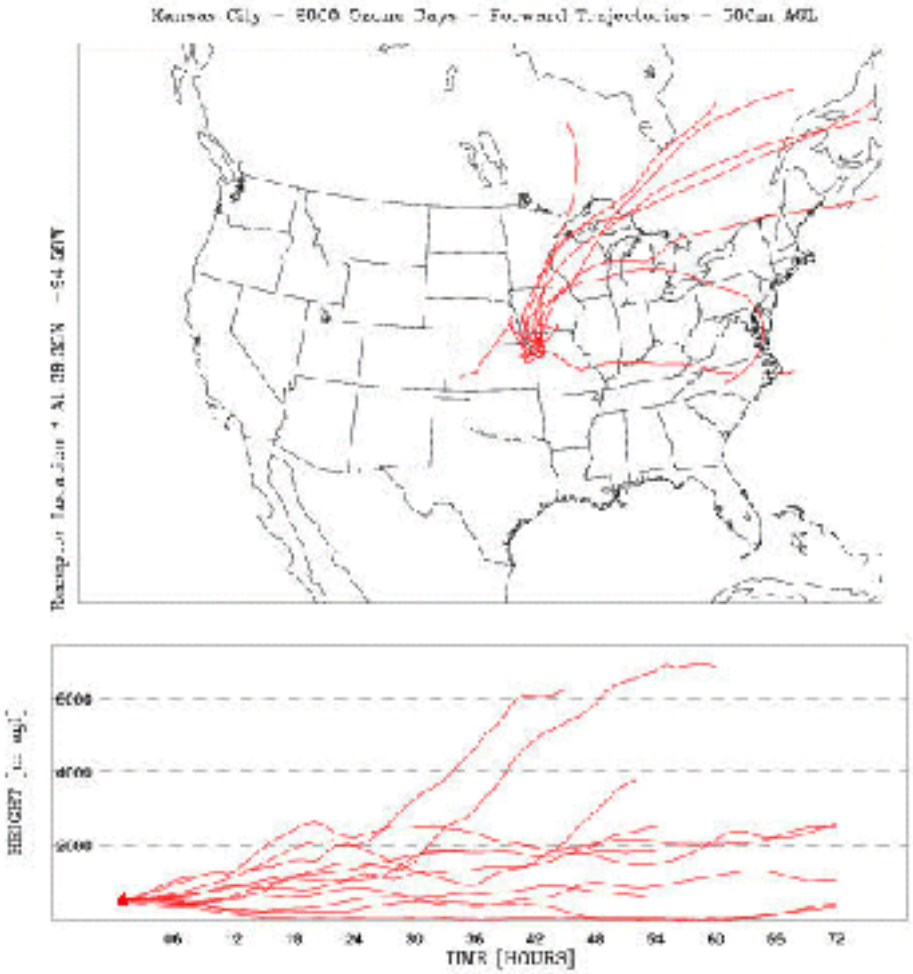
The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication.
Also thanks goes to Joel Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-7. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2001



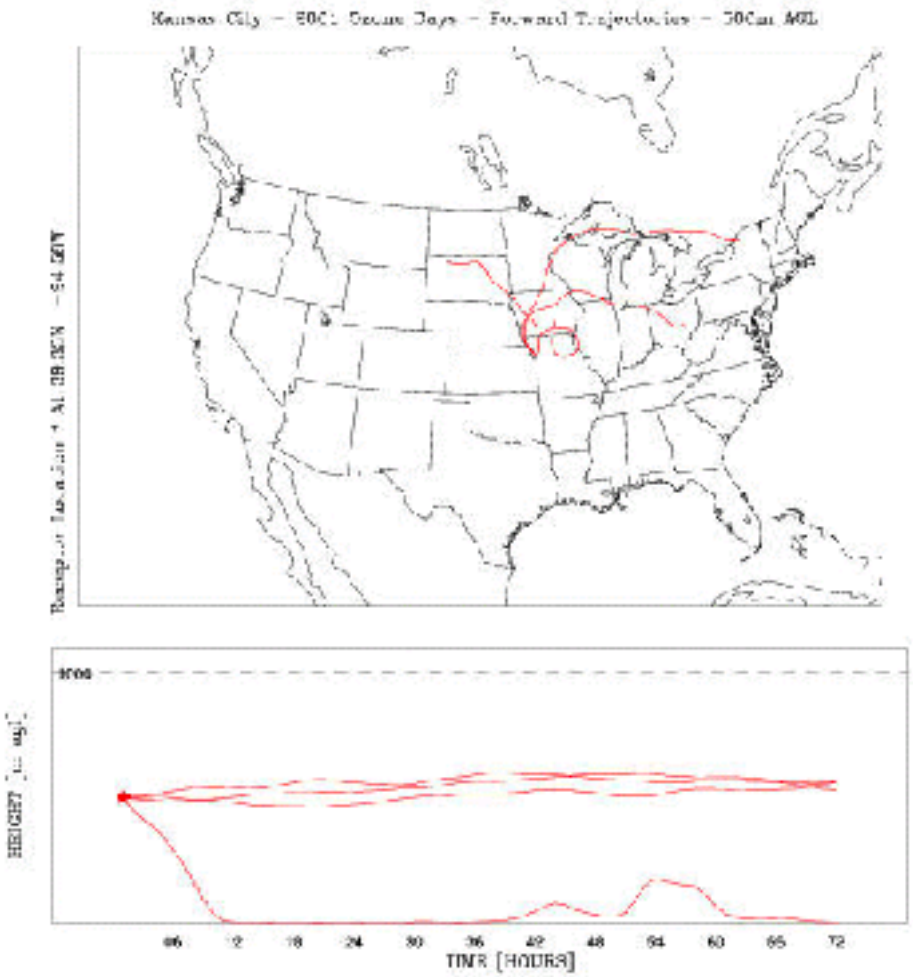
The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication. Also, thanks goes to Bret Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-8. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2002



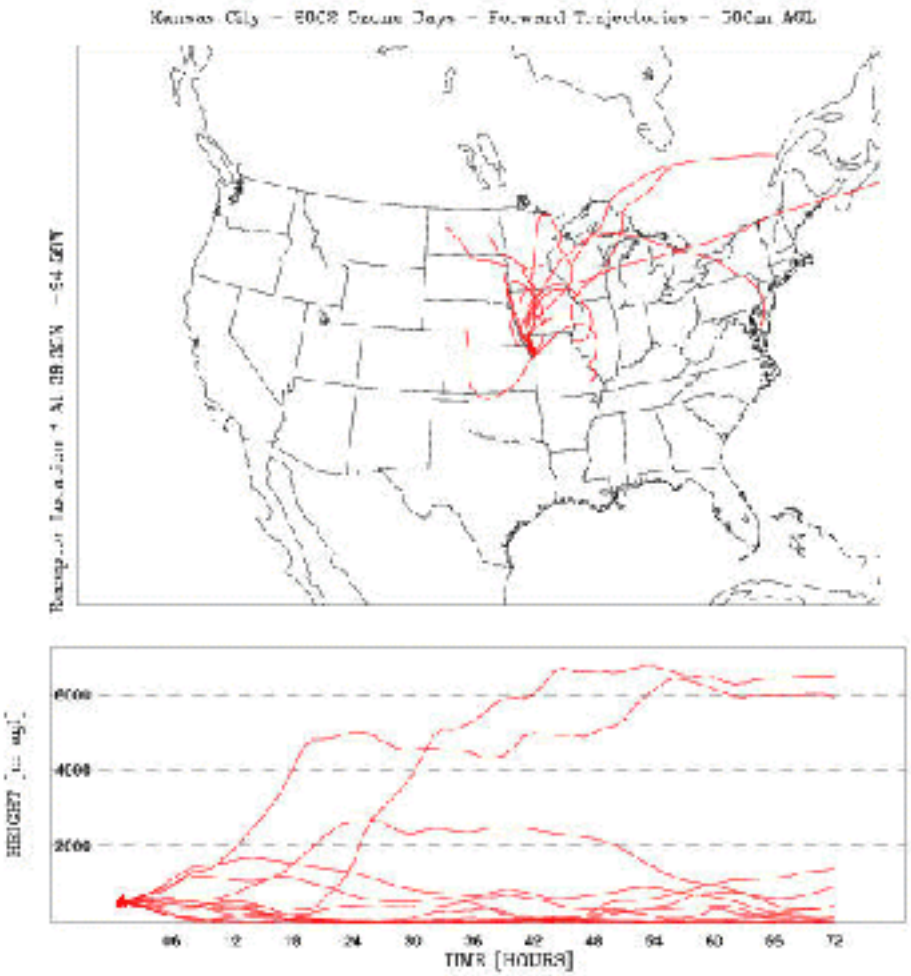
The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication.
Also, thanks goes to Ron Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-9. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2000



The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication.
Also thanks goes to Brett Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-10. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2001



The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication.
Also, thanks goes to Bret Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots

Figure C-11. Kansas City 500m Forward Trajectories, 8-Hr. Ozone Exceedance Days, 2002

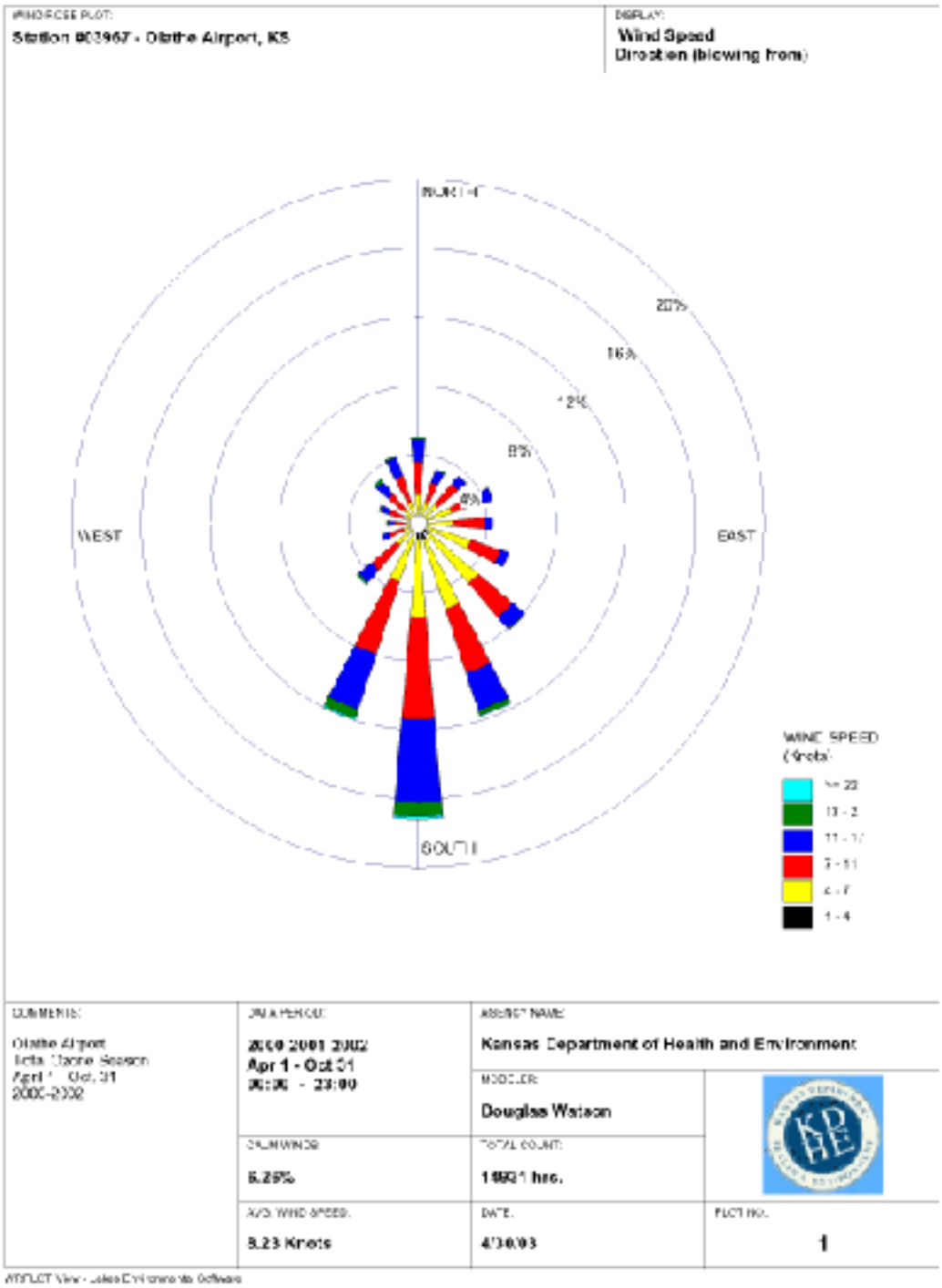


Figure C-12. Olathe Executive Airport Ozone Season Wind Rose (Apr. 1 - Oct. 31, 2000-2002)

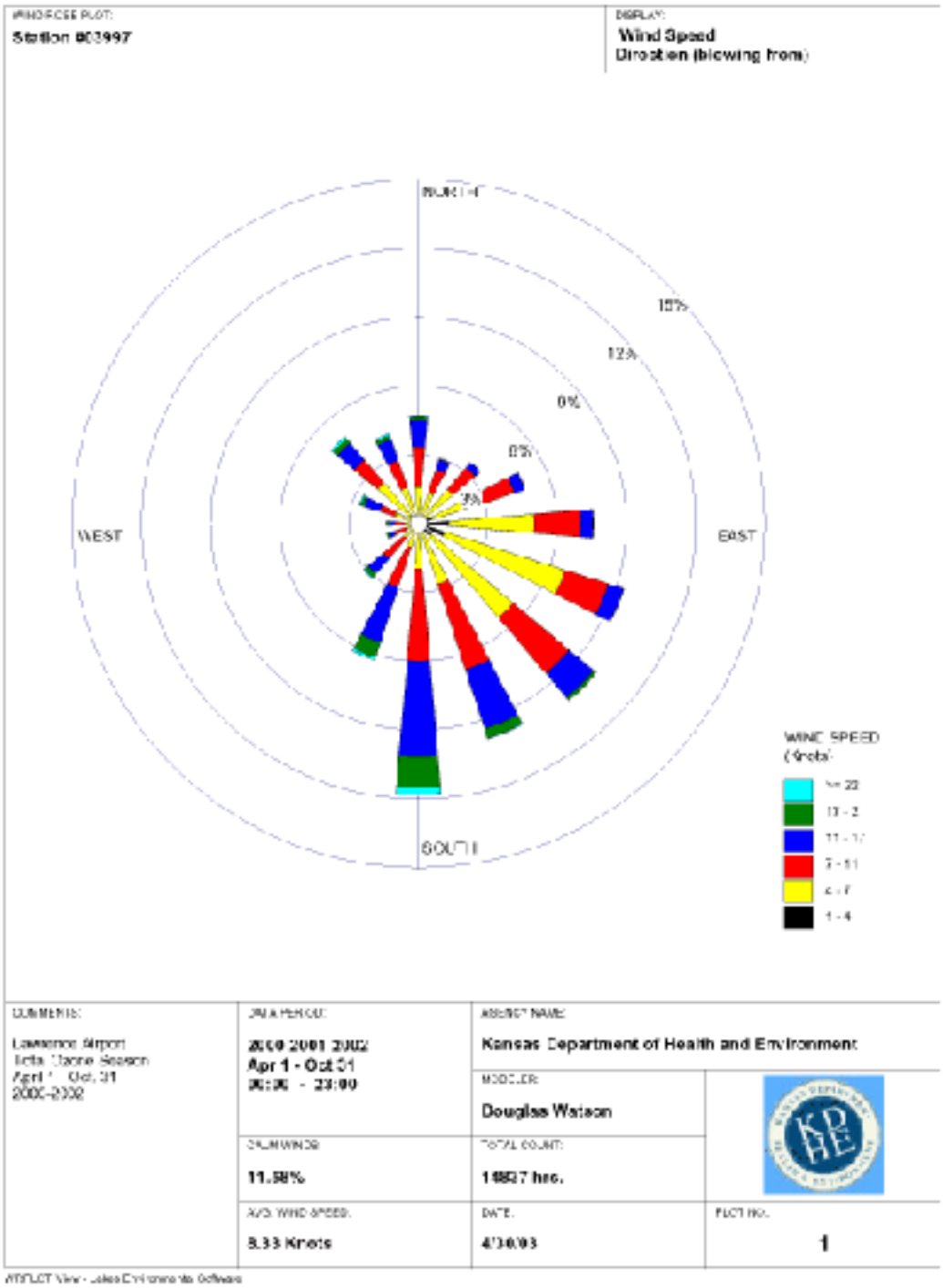
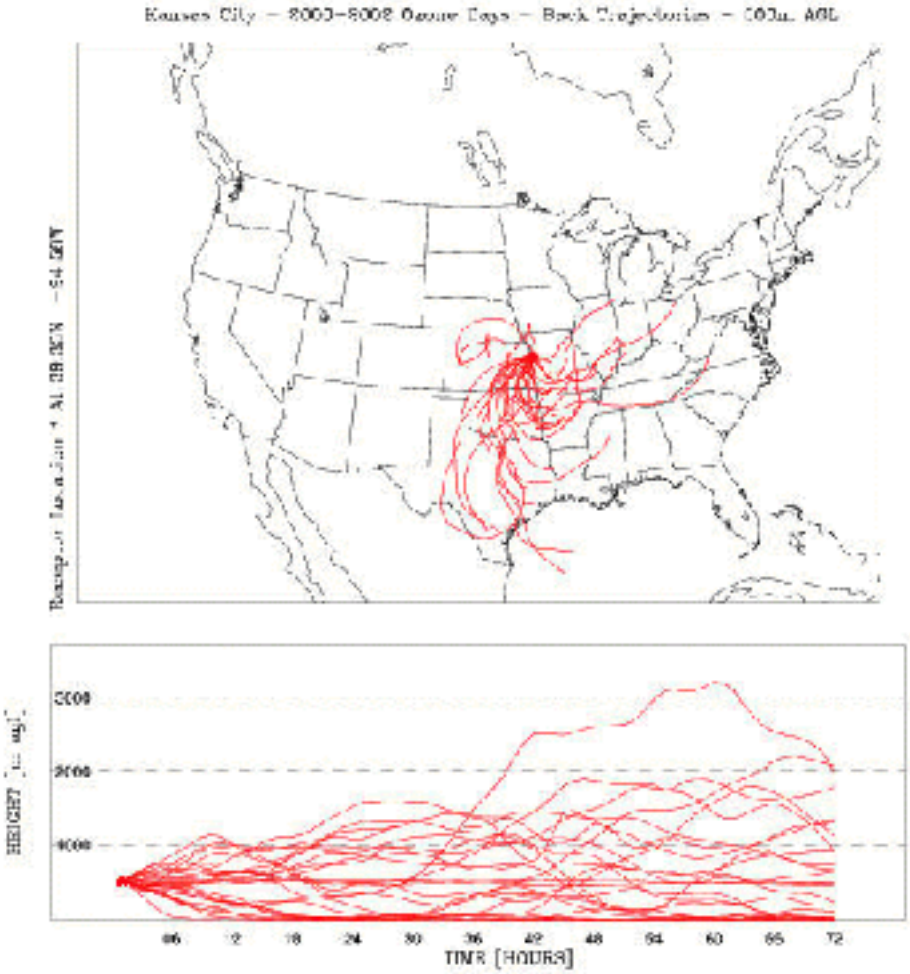


Figure C-13. Lawrence Airport Ozone Season Wind Rose (Apr. 1 - Oct. 31, 2000-2002)



The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.html) used in this publication. Also, thanks goes to Bret Anderson at EPA Region 7 for his help in the development of the program for the production of these spaghetti plots.

Figure C-14. Kansas City 500m Back Trajectories, 8-Hr. Ozone Exceedance Days, 2000-2002

Table C-1. Summary of Meteorological Conditions on 8-Hour Ozone Exceedance Days, 2000 - 2002

YR.	MO.	DAY	SITE NAME	MAX. SAMPLE VALUE (PPM)	MAX. TEMP. (°F)	MIN. TEMP. (°F)	AVG. TEMP. (°F)	AVG. WIND SPEED (MPH)	AVG. WIND DIR. (DEG)
2000	JUNE	8	LIBERTY	0.085	87	63	75	14.8	190
	JULY	14	JFK	0.087	93	69	81	5.1	210
		14	WORLDS OF FUN	0.088					
		16	JFK	0.087	92	71	82	8.8	110
		16	KCI	0.090					
	AUG.	15	LIBERTY	0.100	96	73	85	9.0	200
		15	RG SOUTH	0.090					
		15	WATKINS MILL	0.098					
		15	WORLDS OF FUN	0.089					
		16	KCI	0.085	99	74	87	8.3	150
		24	JFK	0.088	94	71	83	9.8	70
		24	KCI	0.090					
		24	LIBERTY	0.087					
		24	WORLDS OF FUN	0.086					
		27	JFK	0.088	101	74	88	8.0	110
		27	KCI	0.094					
		27	LIBERTY	0.098					
		27	WATKINS MILL	0.087					

YR.	MO.	DAY	SITE NAME	MAX. SAMPLE VALUE (PPM)	MAX. TEMP. (°F)	MIN. TEMP. (°F)	AVG. TEMP. (°F)	AVG. WIND SPEED (MPH)	AVG. WIND DIR. (DEG)
		27	WORLDS OF FUN	0.094					
		29	RG SOUTH	0.099	91	71	81	8.9	80
		30	LIBERTY	0.088	102	75	89	10.2	160
	SEPT.	1	RG SOUTH	0.099	98	67	83	6.2	40
		2	KCI	0.093	106	72	89	8.7	150
		2	LIBERTY	0.103					
		2	WATKINS MILL	0.086	106	72	89	8.7	150
		2	WORLDS OF FUN	0.090					
		7	LIBERTY	0.091	90	63	77	8.9	160
2001	JULY	17	LIBERTY	0.088	95	75	85	9.6	180
		17	WATKINS MILL	0.085					
	AUG	2	LIBERTY	0.087	94	78	86	9.4	190
		4	KCI	0.087	94	73	84	8.0	130
		5	KCI	0.092	94	72	83	8.1	130
2002	JULY	6	ROCKY CREEK	0.089	95	74	85	7.5	100
		7	LIBERTY	0.085	95	73	84	7.8	120
		8	LIBERTY	0.094	96	73	85	7.8	180
		8	WATKINS MILL	0.086					

YR.	MO.	DAY	SITE NAME	MAX. SAMPLE VALUE (PPM)	MAX. TEMP. (°F)	MIN. TEMP. (°F)	AVG. TEMP. (°F)	AVG. WIND SPEED (MPH)	AVG. WIND DIR. (DEG)
		15	JFK	0.086	89	64	77	7.2	120
		15	KCI	0.092					
		15	ROCKY CREEK	0.088					
		16	KCI	0.085	92	65	79	8.4	140
		16	ROCKY CREEK	0.086					
		26	ROCKY CREEK	0.086	103	64	84	12.2	150
		30	ROCKY CREEK	0.089	95	68	82	7.5	160
	AUG.	5	LIBERTY	0.102	97	72	85	6.9	140
		5	ROCKY CREEK	0.097					
		5	WATKINS MILL	0.091					
		9	KCI	0.085	90	64	77	7.5	130
		9	LIBERTY	0.089	90	64	77	7.5	130
		9	ROCKY CREEK	0.091					
		9	WATKINS MILL	0.085					
	SEPT.	5	ROCKY CREEK	0.085	95	69	82	9.1	100
		6	ROCKY CREEK	0.091	97	70	84	8.6	130

YR.	MO.	DAY	SITE NAME	MAX. SAMPLE VALUE (PPM)	MAX. TEMP. (°F)	MIN. TEMP. (°F)	AVG. TEMP. (°F)	AVG. WIND SPEED (MPH)	AVG. WIND DIR. (DEG)
		7	JFK	0.086	96	64	80	9.6	140
		7	KCI	0.088					
		7	LIBERTY	0.087					
		7	RG SOUTH	0.088					
		7	ROCKY CREEK	0.094					
				2000-2002 Averages	95.2	70.0	82.6	8.6	

APPENDIX D
Population and Growth

Table D-1. Summary of Population Data by County

	Population Estimates		Population Forecasts		
	1990	2000	2010	2020	2030
Kansas MSA Counties					
Johnson*	355,021	451,086	550,904	644,559	733,334
Leavenworth	64,371	68,691	75,032	80,471	85,715
Miami	23,466	28,351	32,928	37,665	42,403
Wyandotte*	162,026	157,882	157,417	154,800	151,816
Missouri MSA Counties					
Cass	63,808	82,092	101,004	119,018	135,942
Clay*	153,411	184,006	212,386	236,914	260,275
Clinton	16,595	18,979	forecasts not available		
Jackson*	633,234	654,880	684,840	702,429	719,372
Lafayette	31,107	32,960	forecasts not available		
Platte*	57,867	73,781	88,432	101,488	113,752
Ray	21,968	23,354	24,383	25,192	25,948
Other Kansas Counties					
Douglas	81,798	99,962	104,960	109,159	112,433

* Counties in the Kansas City Maintenance Area

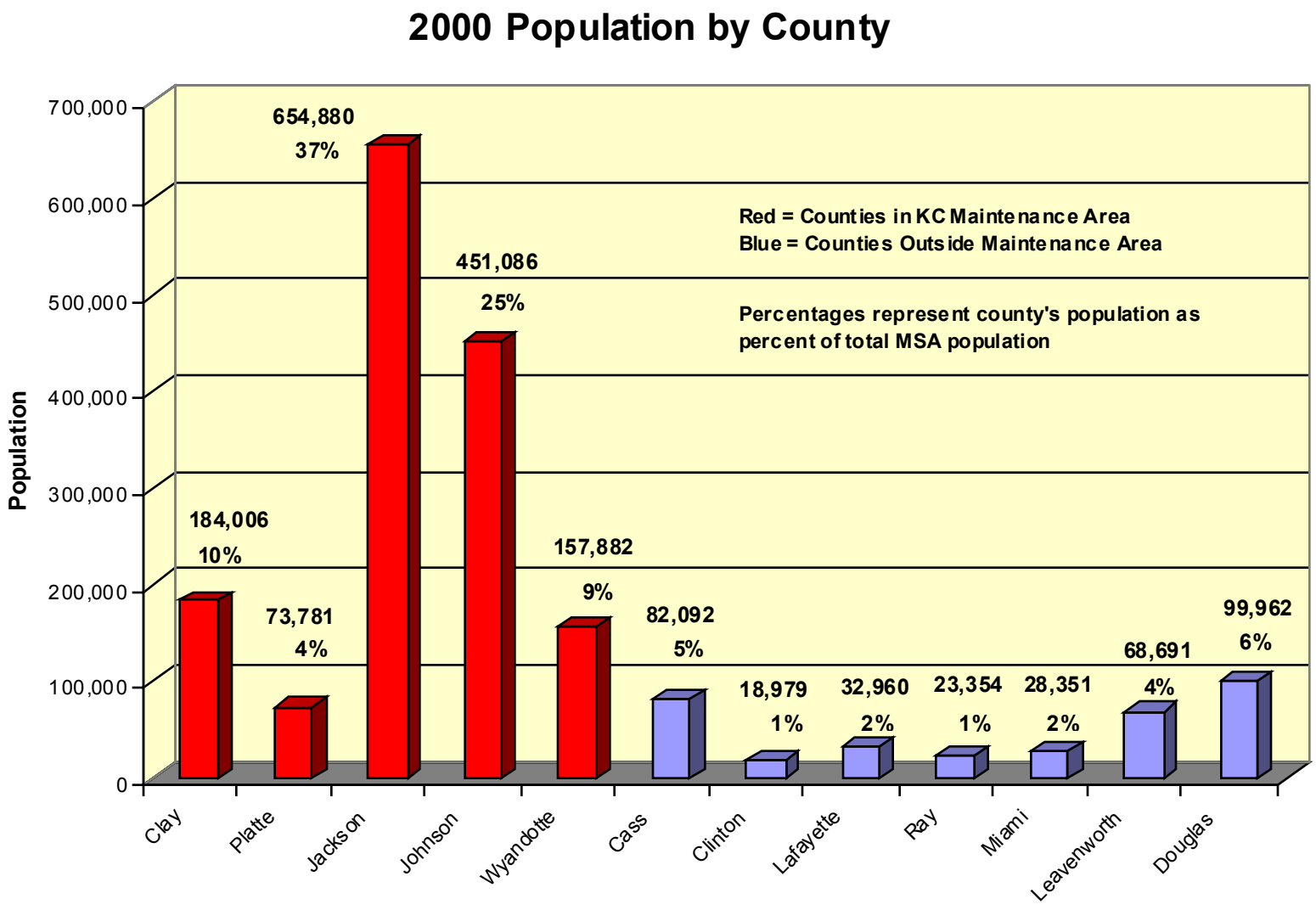
Sources: 1990 and 2000 data from U.S. Census Bureau. Projections for all counties except Miami and Douglas from Mid-America Regional Council, 2002 Kansas City Metropolitan Area Long-Range Forecast, October 2002. Projections for Douglas and Miami counties from Kansas Division of the Budget, The Governor's Economic and Demographic Report 2001-2002, January 2002.

Table D-2. Summary of Population, Employment, and Average Daily Vehicle Miles Traveled (ADVMT) in Kansas City Area Counties

	2000 Population	Pop as % of MSA Pop	2000 Employment	Emp as % of MSA Emp	1999 ADVMT	ADVMT as % of MSA ADVMT
Kansas MSA Counties						
Johnson*	451,086	25.4	282,652	31.7	13,289,730	24.4
Leavenworth	68,691	3.9	15,044	1.7	1,409,053	2.6
Miami	28,351	1.6	6,868	0.8	1,015,673	1.9
Wyandotte*	157,882	8.9	61,588	6.9	4,668,108	8.6
Missouri MSA Counties						
Cass	82,092	4.6	15,483	1.7	2,680,904	4.9
Clay*	184,006	10.4	84,593	9.5	6,317,145	11.6
Clinton	18,979	1.1	3,433	0.4	917,787	1.7
Jackson*	654,880	36.9	376,186	42.2	18,539,255	34.0
Lafayette	32,960	1.9	7,087	0.8	1,955,389	3.6
Platte*	73,781	4.2	35,766	4.0	3,159,378	5.8
Ray	23,354	1.3	3,721	0.4	497,002	0.9
Maintenance Area Totals	1,521,635	85.7	840,785	94.2	45,973,616	84.4
MSA Totals	1,776,062	100.0	892,421	100.0	54,449,424	100.0
Other Kansas Counties						
Douglas	99,962	5.6	37,485	4.2	2,387,176	4.4

* Counties in the Kansas City Maintenance Area

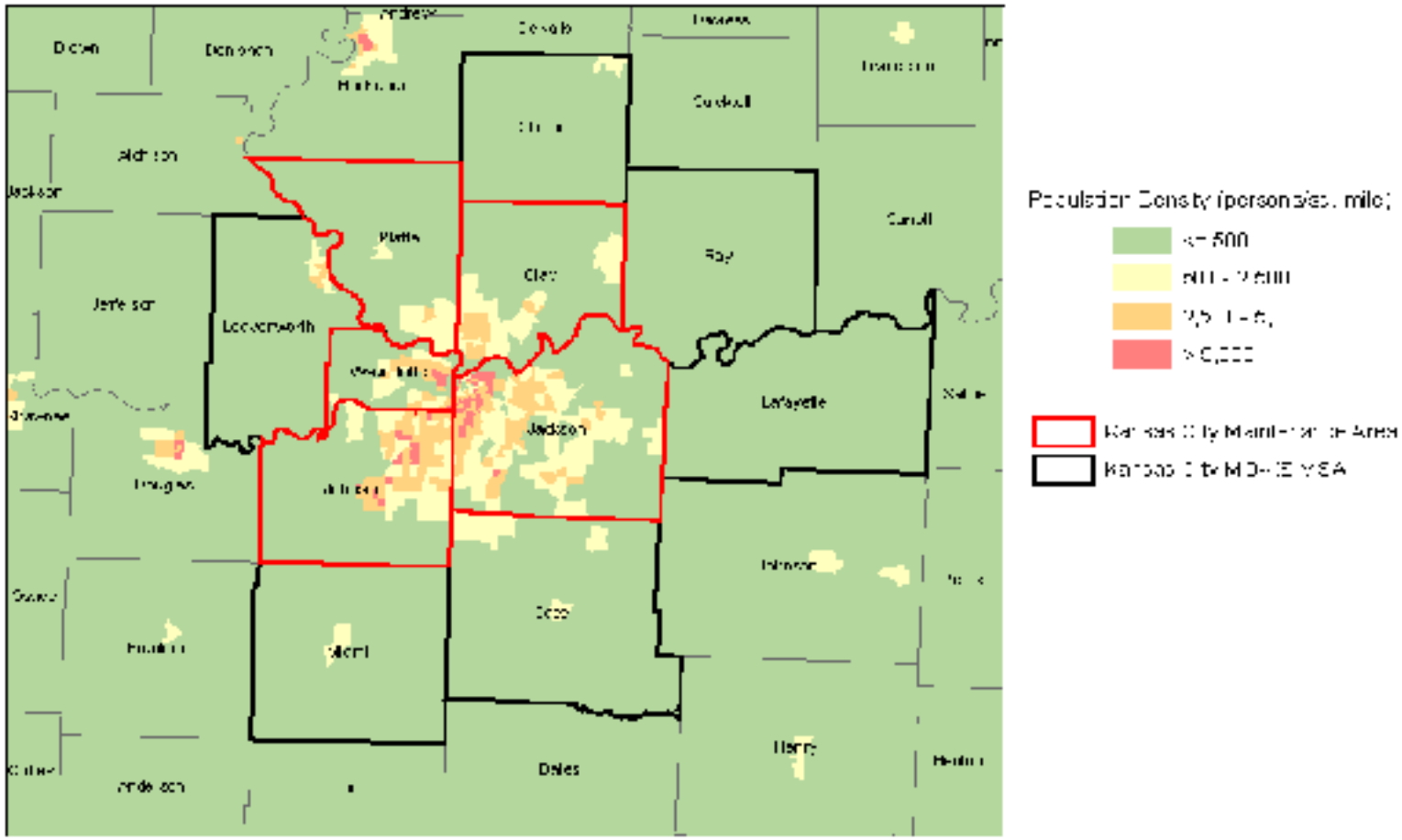
Sources: U.S. Census Bureau, 2000 Census. Employment data from County Business Patterns. ADVMT within Maintenance Area from MARC. ADVMT for KS counties outside Maintenance Area from KDOT. ADVMT for MO counties outside Maintenance Area from MoDOT.



Source: U.S. Census Bureau, 2000 Census.

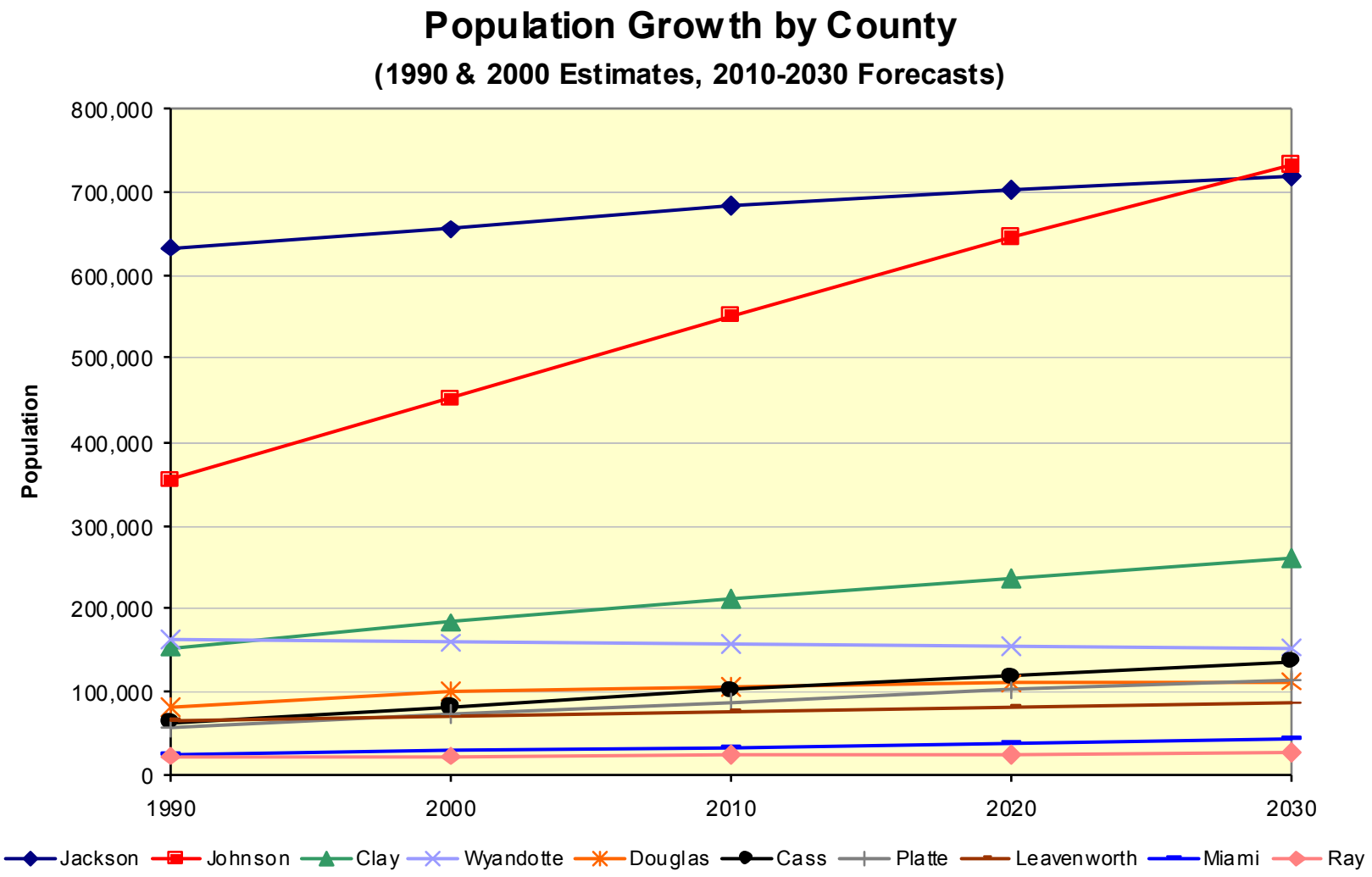
Figure D-1. 2000 Population by County

2000 Population Density by Census Tract



Source: U.S. Census Bureau, U.S. Census 2000 TIGER data

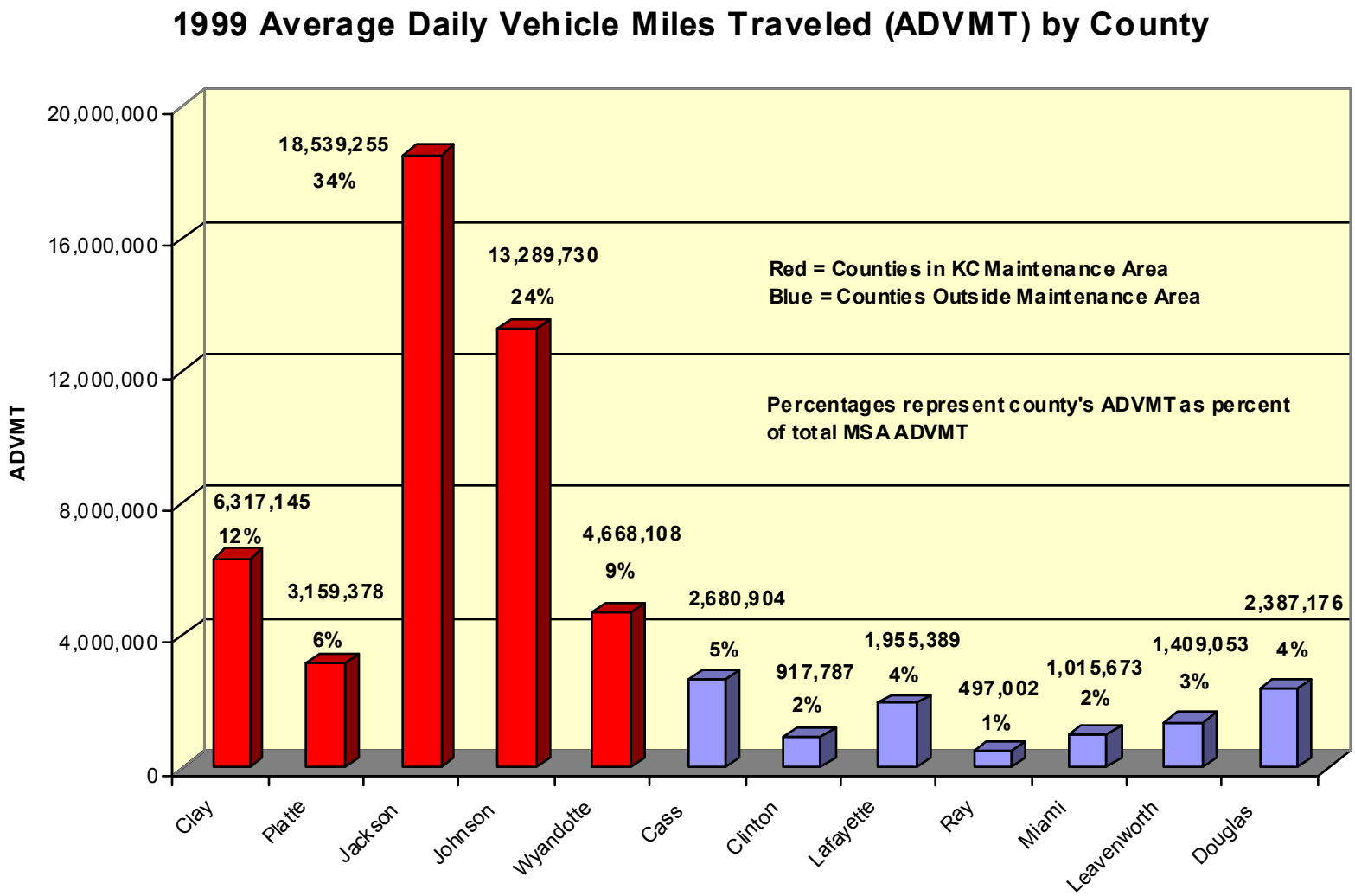
Figure D-2. 2000 Population Density by Census Tract



Sources: 1990 and 2000 data from U.S. Census Bureau. Projections for all counties except Miami and Douglas from Mid-America Regional Council, 2002 Kansas City Metropolitan Area Long-Range Forecast, October 2002. Projections for Douglas and Miami counties from Kansas Division of the Budget, *The Governor's Economic and Demographic Report 2001-2002*, January 2002.

Figure D-3. Population Growth by County

APPENDIX E
Transportation



Sources: Mid-America Regional Council for ADVMT within Maintenance Area counties. Kansas Dept. of Transportation for ADVMT within KS counties outside Maintenance Area. Missouri Dept. of Transportation for ADVMT within MO counties outside Maintenance Area.

Figure E-1. 1999 Average Daily Vehicle Miles Traveled by County

Table E-1. Commute Patterns in the Kansas City Region

Values in the table are numbers of round-trip work trips.

COUNTY OF RESIDENCE	COUNTY OF EMPLOYMENT												Totals: # Work Trips *From* County	
	Kansas MSA				Missouri MSA							Other KS		
	John.*	Leav.	Miami	Wyand.*	Cass	Clint.	Clay*	Jack.*	Laf.	Platte*	Ray	Doug.	Sum	% MSA Work Trips
Kansas MSA														
Johnson*	165,924	847	564	14,791	587	0	3,766	49,687	33	1,984	13	1,462	239,658	27.8
Leavenworth	3,560	19,105	25	3,793	72	0	351	1,701	7	712	0	785	30,111	3.5
Miami	5,950	14	5,930	427	94	0	70	934	7	31	0	120	13,577	1.6
Wyandotte*	18,996	612	63	31,919	75	0	1,707	11,004	3	1,163	0	200	65,742	7.6
Missouri MSA														
Cass	6,686	10	224	977	14,616	0	816	16,208	42	216	5	38	39,838	4.6
Clinton	146	17	0	291	5	3,015	2,257	1,004	6	441	47	16	7,245	0.8
Clay*	5,938	229	8	4,267	113	194	47,238	26,812	11	10,039	372	75	95,296	11.0
Jackson*	39,018	259	80	11,585	2,777	36	14,451	233,408	538	4,078	123	308	306,661	35.5
Lafayette	341	5	7	281	93	2	502	5,184	7,926	72	258	2	14,673	1.7
Platte*	3,304	793	10	2,452	26	64	7,119	9,548	17	16,264	9	32	39,638	4.6
Ray	161	2	0	300	4	32	3,806	1,794	297	246	3,883	0	10,525	1.2
Other Kansas														
Douglas	5,578	509	58	796	8	0	149	1,450	0	60	0	41,414	50,022	5.8
Totals: # Work Trips *To* County														
Sum	255,602	22,402	6,969	71,879	18,470	3,343	82,232	358,734	8,887	35,306	4,710	44,452		
% MSA Work Trips	29.4	2.6	0.8	8.3	2.1	0.4	9.5	41.3	1.0	4.1	0.5	5.1		

* Counties in the Kansas City Maintenance Area

Sources: U.S. Census Bureau, 2000 Census. Data compiled by MARC.

APPENDIX F
Topography and Geography

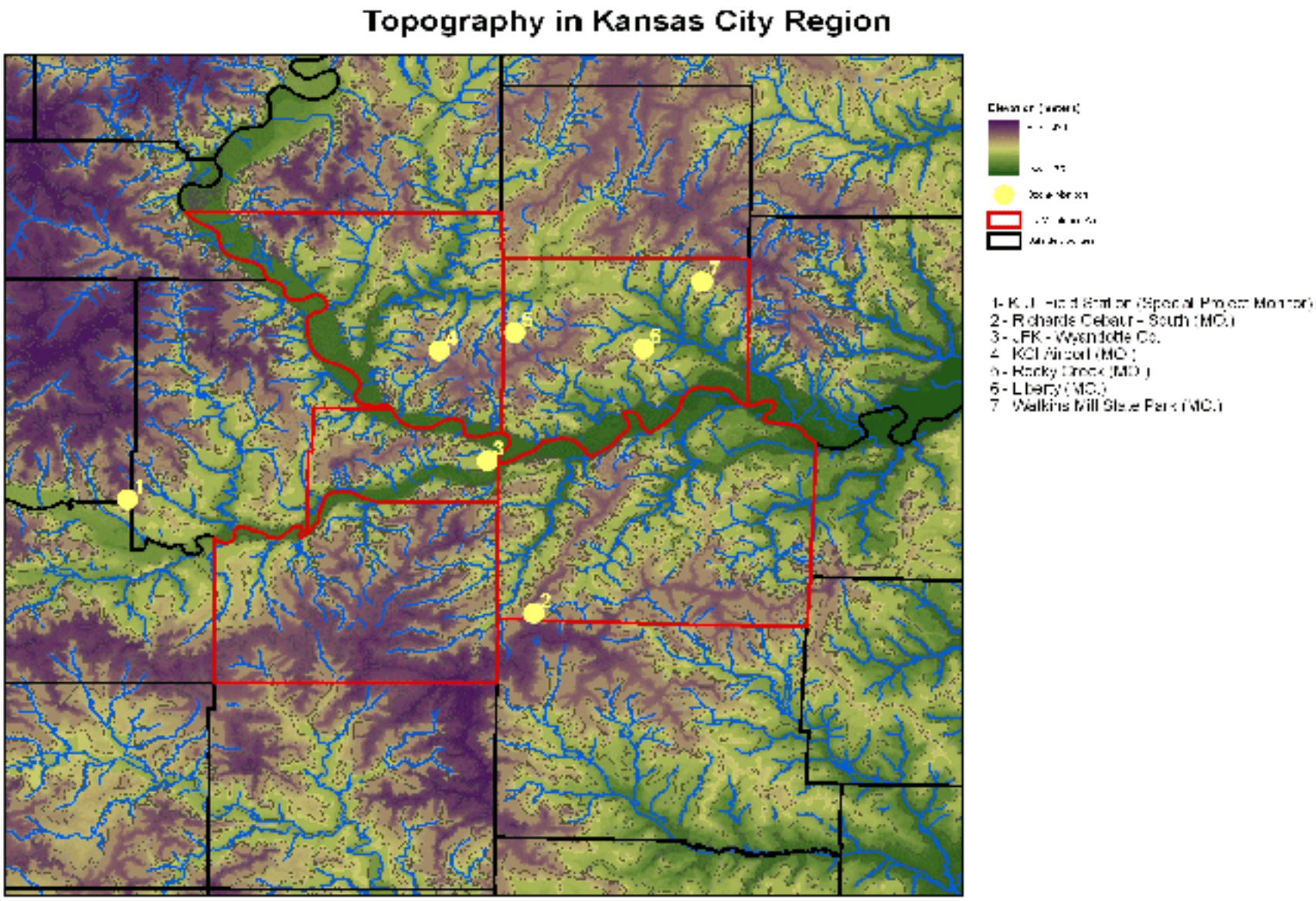


Figure F-1. Topography of Kansas City Area and Locations of Ozone Monitoring Sites

APPENDIX G
Other Supporting Materials

600 Broadway, Suite 300
Kansas City, Missouri 64105-1554

816/474-4240
816/421-7758 FAX
www.marc.org

MARC

Mid-America Regional Council

June 12, 2003

Roderick L. Bremby, Secretary
Kansas Department of Health & Environment
Charles Curtis State Office Building
1000 SW Jackson
Topeka, KS 66612

Dear Secretary Bremby:

Members of the Mid-America Regional Council (MARC) Air Quality Forum, in cooperation with state and local stakeholders, recently completed an extensive analysis of data related to the Kansas City region's air quality status and air quality planning boundary. The MARC Board of Directors is pleased to endorse the boundary recommendations the Forum developed as part of this process.

In April 2004, the U.S. EPA will implement a new federal standard for ground-level ozone. Current data suggest the Kansas City region will not meet this standard. In April of this year, members of the MARC Air Quality Forum, state air agency personnel and representatives of adjacent counties convened to examine issues related to the new standard. EPA has indicated that, in the absence of an alternate recommendation from state governors, the default air quality boundary under the new ozone standard would include the entire 11-county Kansas City Metropolitan Statistical Area.

Per guidance from EPA, the MARC ozone technical work group considered data related to regional emissions, air quality monitor readings, meteorology, and current and forecasted demographics. Based on its analysis, the group reached consensus regarding a proposed boundary. The group recommended that the five counties currently in the air quality maintenance area – Johnson and Wyandotte Counties in Kansas, and Clay, Jackson and Platte Counties in Missouri – be included in the new boundary. The group further proposed that the portion of Cass County, Missouri, in the MARC metropolitan planning organization boundary be included in the air quality planning district under the new ozone standard. The MARC Board of Directors, Air Quality Forum and Total Transportation Policy Committee have endorsed these recommendations, which are outlined in more detail in the attached map and memo from the MARC ozone technical work group.

We are pleased that these recommendations resulted from an open and inclusive process involving many stakeholders. We believe proposed boundary changes will do much to protect the health of greater Kansas City residents and will help the region meet the new ozone standard in an expeditious manner. If you have questions or concerns related to the MARC boundary recommendations, please call James Joerke of my staff at 816/474-4240.

Sincerely,

David A. Warm
Executive Director

Enc.

Chair
Dr. Charles A. Eddy
Councilmember
Kansas City, MO

1st Vice Chair
Carol Marinovich
Mayor/CEO
Unified Government of Wyandotte County/ Kansas City, KS

2nd Vice Chair
Gary Mallory
Presiding Commissioner
Cass County, MO

Treasurer
Tom Brown
Commissioner
Clay County, MO

Secretary
Ronald L. Shaffer
Mayor
Prairie Village, KS

Executive Director
David A. Warm

PRINTED ON 30% POST CONSUMER RECYCLED PAPER

Memorandum

To: MARC Air Quality Forum
From: Eight-Hour Technical Work Group
Re: Kansas City Air Quality Boundary Recommendation
Date: May 7, 2003

Background

Monitor readings from recent years suggest the Kansas City region may be redesignated a nonattainment area when EPA implements the new federal eight-hour ozone standard in April 2004. By July 15, 2003, the states of Kansas and Missouri must submit recommendations to the U.S. EPA regarding the Kansas City air quality boundary. At its meeting on March 11, 2003, the Air Quality Forum requested that a technical work group be formed to examine data related to the boundary issue. The work group, consisting of local, state and federal air agency staff, MARC staff, and representatives from counties outside the maintenance area, met for a total of nine hours on April 8 and 29. The group's purpose was to review data related to the eleven boundary criteria established by the U.S. EPA, and to advise the Air Quality Forum and state air agencies regarding the potential for each of thirteen counties to contribute to regional ozone pollution. The conclusions below reflect a consensus of work group members but not necessarily the unanimous endorsement of all representatives in the group.

Conclusions

Based on its consideration of the issues, members of the technical work group request that the Air Quality Forum endorse the following recommendations:

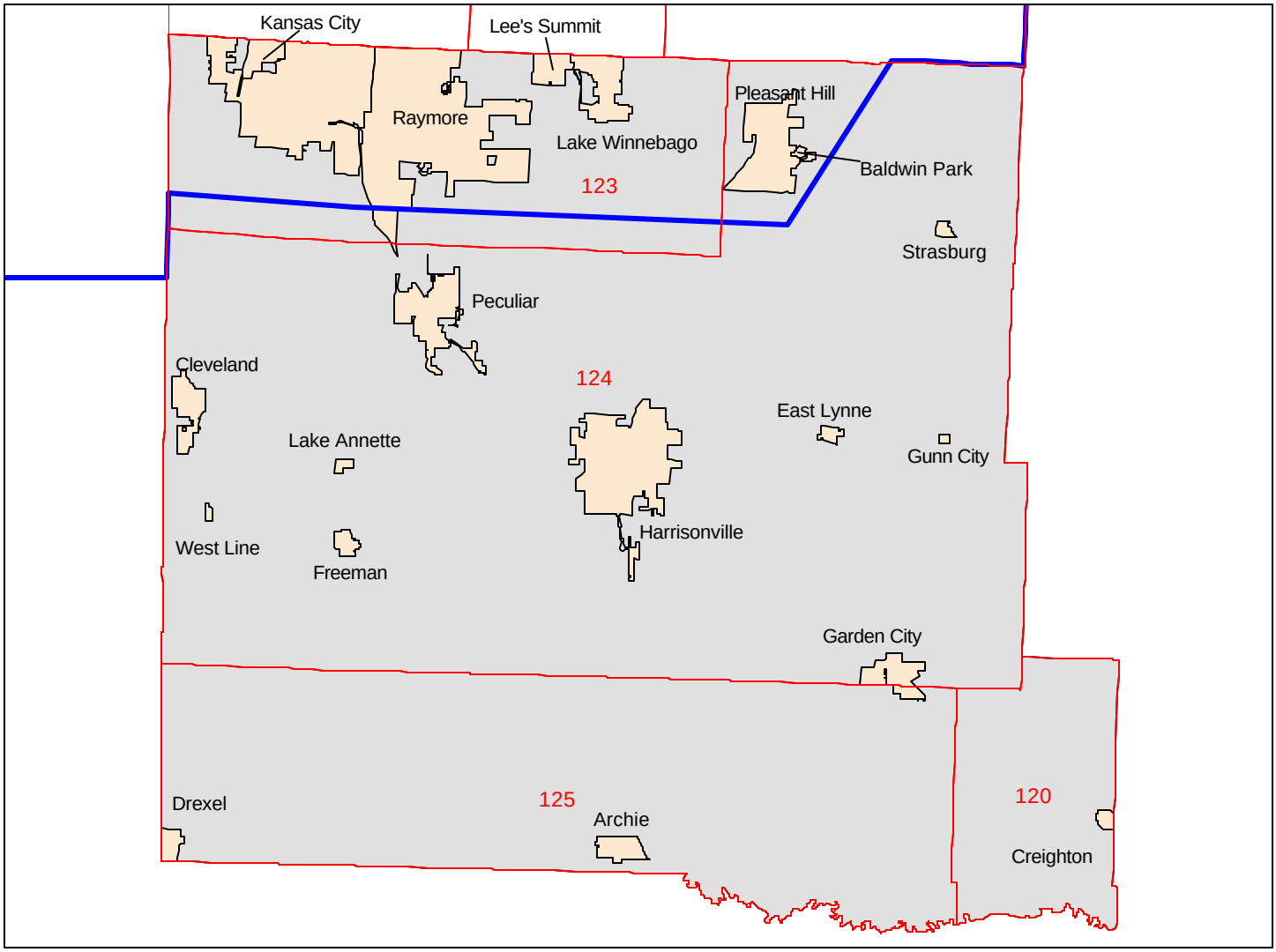
1. **That the five counties comprising the Kansas City maintenance area – Johnson and Wyandotte Counties in Kansas, and Clay, Jackson and Platte Counties in Missouri – remain within the air quality boundary when the eight-hour ozone standard is implemented in April 2004.** Together these counties are home to over 1.5 million residents and account for a majority of the volatile organic compound (VOC) and nitrogen oxide (NOx) emissions in the Kansas City Metropolitan Statistical Area (KCMSA). The work group could find no compelling reason to exclude any of the five counties from the boundary.
2. **That Leavenworth County, Kansas, and Clinton, Ray and Lafayette Counties in Missouri, be excluded from the Kansas City air quality boundary under the eight-hour ozone standard.** These KCMSA counties account for only a small portion of the regional VOC and NOx emissions inventory. Prevailing winds associated with high ozone days generally do not carry pollutants from these counties into the Kansas City urbanized area. However, it is possible that one or more of these counties may experience elevated ozone levels caused by emissions generated elsewhere in the region. Should future ozone monitoring data indicate that violations of the eight-hour standard are occurring in one or more of these counties, it may become necessary to reevaluate the nonattainment boundary.
3. **That Douglas County, Kansas, be excluded from the air quality boundary.** While Douglas County is not in the KCMSA, the work group considered the county's potential contribution to air pollution in greater Kansas City. The county's population is around 100,000, but prevailing winds associated with high ozone days do not frequently carry pollutants from Douglas County into the Kansas City urbanized area. Approximately 8,000 daily commute trips to the maintenance area originate in Douglas County. Should future ozone monitoring data indicate that violations of the eight-hour standard are occurring in Douglas County, it may become necessary to reevaluate the nonattainment boundary.

4. **That minimally, the portion of Cass County within the MARC metropolitan planning organization (MPO) boundary be included in the air quality boundary under the new ozone standard.** This area, which contains Belton, Raymore and Pleasant Hill, and a small portion of Kansas City, Missouri, is part of the contiguous Kansas City urbanized area (see attached Cass County MPO Boundary map). From 1990 to 2000, the county's population grew at a rate of over 27.8 percent, making it the fastest-growing county in the KCMSA. An estimated 56 percent of the county's 82,000 residents live within the MARC MPO boundary. Data from the 2000 Census show that nearly 25,000 daily work trips into the maintenance area originate in Cass County. Because Cass County lies south of the Kansas City urbanized area, prevailing winds associated with high ozone days carry pollutants from the county into the most heavily-populated parts of the region. The group's recommendation to include only the northern part of Cass County, rather than the entire county, assumes that most of the VOC emissions are encompassed by the boundary and that the MPO boundary is not subject to change.
5. **That Miami County, Kansas, be excluded from the air quality boundary.** Miami County has fewer than 30,000 residents and generates fewer than 7,500 commuter trips into the maintenance area. The county is not part of the contiguous Kansas City urbanized area and accounts for only a small fraction of the total VOC emissions in the KCMSA.

   While Miami County appears to be a minor contributor to VOC emissions in greater Kansas City, the work group is concerned about the potential impacts of NOx point sources located in Miami and Linn Counties. Both counties lie upwind of the Kansas City urbanized area. Linn County, in particular, contains a power plant that accounts for most of the 37,200 tons of NOx emissions the county generated in 1999.

   The extent to which NOx emissions influence regional ozone production is currently being studied by the state air agencies. Members of the work group urged the Kansas Department of Health and Environment to continue to study the impacts of Miami and Linn County NOx point sources on air quality in the Kansas City region, and to provide the Air Quality Forum with additional information about the issue as soon as is feasible. Such information may necessitate reconsideration of whether Miami or Linn counties should become part of the nonattainment area.

Cass County MPO Boundary



MPO Boundary