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Kansas Air Quality Progress Report

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A Review of Air Quality Improvements in the State of Kansas Under the Clean Air Act

Background

The first Clean Air Act promoting uniform laws and cooperative activities between the states and the federal government to control air pollution was approved in the Congress on December 17, 1963. This statute authorized federal grant funds to support state, local, and multijurisdictional agencies in their efforts to control air pollutant emissions. This Act was amended on November 21, 1967. This amended Act established the statutory concepts of air quality standards, air quality control regions, and state implementation plans (SIP).

The Kansas Legislature adopted the first statute concerning air pollution control activities in 1967. The state placed responsibility in the Department of Health and, among other things, authorized acceptance of federal grant funds to support air pollution control activities. Since that time, the air pollution control activities were placed under the Department of Health and Environment, and there have been several revisions to the Kansas statute in response to needs of the air program.

The 1967 Clean Air Act required the Secretary of Health, Education, and Welfare to identify air basins, both interstate and intrastate. The Secretary was required to prepare air quality criteria documents for pollutants of concern and companion documents identifying control techniques. The states were to use those criteria documents as guides for developing air quality standards which would protect the public against health and welfare effects of the identified criteria pollutants. Under the authority of the 1967 Act, the Department of Health, Education, and Welfare designated six intrastate and one interstate air quality control regions in Kansas in 1970. Figure 1 shows the boundaries for those regions.

The Environmental Protection Agency (EPA) was created in 1970 and was given responsibility for the air pollution control program.

The Clean Air Act of 1970 required the Administrator of EPA to promulgate National Ambient Air Quality Standards (NAAQS) and prepare guidelines for the states to use in preparing plans for attainment and maintenance of those standards. EPA promulgated the NAAQS April 30, 1971.

Table I contains the air quality standards for criteria pollutants. The table includes total suspended particulate matter (TSP) even though EPA replaced the TSP standard with PM_{10} in 1987. The rationale for including TSP in this report is that all states have long-term data, and those data show the change or improvement in air quality over a long period of time. PM_{10} data have only been gathered for a short period and any trends are not yet apparent.

Table I
National Ambient Air Quality Standards

	Primary[1]	Secondary[1]
Total suspended particulate matter (TSP) (standard was replaced by PM_{10} in 1987)	75 $\mu g/m^3$ annual geometric mean 260 $\mu g/m^3$ 24-hour value not to be exceeded more than once per year	150 $\mu g/m^3$ 24-hour value not to be exceeded more than once per year
PM_{10} (July 1, 1987)	50 $\mu g/m^3$ annual mean 150 $\mu g/m^3$ 24-hour average not to be exceeded more than once per year	Same as primary
Sulfur Dioxide	80 $\mu g/m^3$ annual arithmetic mean 365 $\mu g/m^3$ maximum 24-hour concentration not to be exceeded more than once per year	1300 $\mu g/m^3$ maximum 3-hour concentration not to be exceeded more than once per year
Ozone (as revised February 8, 1979)[2]	0.12 ppm (235 $\mu g/m^3$) 1-hour average concentration not to be exceeded more than once per year	Same as primary
Carbon Monoxide	9 ppm (10 mg/m^3) maximum 8-hour concentration not to be exceeded more than once per year 35 ppm (40 mg/m^3) maximum 1-hour concentration not to be exceeded more than once per year	Same as primary
Nitrogen dioxide	0.053 ppm (100 $\mu g/m^3$) annual arithmetic mean	Same as primary
Lead (October 5, 1978)	1.5 $\mu g/m^3$ maximum arithmetic mean averaged over a calendar quarter	Same as primary

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1 Primary standards are set to protect public health and secondary standards to protect public welfare.

2 The initial promulgation included photochemical oxidants and hydrocarbons. The photochemical oxidant standard was revised to ozone in 1979 because the preponderance of photochemical oxidants measured is ozone. The hydrocarbon standard was deleted in 1982. The hydrocarbon measurements included all organic compounds. Hydrocarbons were measured as a precursor to ozone, but only reactive organic compounds take part in the photochemical reaction producing ozone. The term "hydrocarbon" has been dropped and replaced with the term "volatile organic compounds" (VOC) because not all hydrocarbons are reactive.

Section 110 of the 1970 Act required submittal of SIPs within nine months of standard promulgation. The state of Kansas submitted its plan on January 31, 1972. EPA approved the plan on May 31, 1972. The Federal Register publication identified deficiencies in the Kansas plan which were to be corrected in a reasonable time. The basic plan provided for attainment and maintenance of the NAAQS. The Kansas SIP also included an Emergency Episode Plan. That plan provided for curtailment of operations at certain sources in the event air quality levels increased to certain concentrations and meteorological conditions were expected to contribute to air stagnations for an extended period of time.

The state of Kansas revised its statute, as well as rules and regulations subsequent to the 1972 plan submittal, to cure deficiencies identified in the May 31, 1972, rulemaking.

The Clean Air Act, as amended in 1977, significantly added to the state and EPA responsibilities. The states were required to identify areas in their jurisdiction where air quality was worse than the NAAQS, equal to or better than the NAAQS, and where there were insufficient data to determine the air quality. These areas became known as nonattainment, attainment, and unclassifiable. EPA promulgated a list of those areas on March 3, 1978. Table II identifies the Kansas nonattainment areas designated in 1978. The states were required to submit plans for attainment and maintenance of standards in the nonattainment areas within nine months. Areas with air quality equal to or better than a national standard were subject to the prevention of significant deterioration (PSD) requirements of Part C of the Act. The PSD requirements were adopted to protect areas with air quality meeting the national standards. The 1977 amendments provided for certain sanctions if states did not adopt or implement plans providing for attainment of the standards.

In response to the 1977 amendments, the initial Kansas plan was submitted September 17, 1979, with subsequent revisions in October 1979 and March 1980. EPA approved the Kansas plan with conditions April 3, 1981. During the subsequent years, the state submitted revisions to satisfy the conditions of the 1981 approval and cure identified plan deficiencies. The SIP and the subsequent revisions provided a strategy for attainment and maintenance of standards in the nonattainment areas. Among other control measures, the plan required reasonably available control technology (RACT) on all major sources in the nonattainment areas. The state also adopted provisions requiring lowest achievable emissions rates for new sources in nonattainment areas. Later, the state adopted requirements for best available control technology (BACT) in attainment areas to prevent significant deterioration of air quality.

The state submitted a lead SIP on February 17, 1981, to satisfy the requirements of the Act in response to EPA's promulgation of the ambient lead standard on October 5, 1978. EPA approved the Kansas lead SIP October 22, 1981.

EPA promulgated PM_{10} standards replacing the TSP standards of 1971 on July 1, 1987. Kansas submitted a final PM_{10} SIP revision on October 31, 1989, which EPA approved on January 16, 1990. All remaining TSP nonattainment areas were designated "unclassified" with respect to the old standard.

Table II
Kansas Nonattainment Area Designations (1978)

County	Primary TSP	Secondary TSP	Ozone	CO	SO_2
Wyandotte	P	P	W	P	
Shawnee	P				
Johnson			W		
Douglas			W		
Sedgwick				P	

P—Partial
W—Whole county

Kansas' Air Quality Progress

The data discussion that follows is not to be construed to be an exhaustive or detailed data analysis. An effort was made to use data from 1974 through 1988 as an indication of air quality changes or improvements. Where monitor sites were discontinued and/or relocated, this was not possible. If a monitor was relocated in the same general area in order to provide a continuing overview, the new location was used to provide the continuity sought. This has introduced some data bias; however, the intent is to merely illustrate continuing air quality changes over the time period stated above. Where multiple monitor sites exist, a single site somewhat representative of the overall air quality of an area was selected. Some of the selected sites may not be either a best- or worst-case site in an area.

Table III shows a chronological record of the redesignation of areas in Kansas since the original areas were identified in 1978. These redesignations occurred primarily as a result of changes in air quality. Most represent an improvement in the status of the area.

Particulate Matter (TSP and PM_{10})

Figure 2 shows the variations of the annual geometric mean concentration for TSP for selected sites in Kansas. These sites were selected because they appear representative of air quality and monitoring was continuous without interruption for a period

of 14 to 15 years, and, thus, indicate a long-term trend. The TSP site for Kansas City, Kansas, is an exception because there are no long-term data prior to 1978 for TSP.

Table III
Redesignation of Kansas Nonattainment Areas

Area (County)	Redesignation From	Redesignation To	Date
Kansas City (Wyandotte)	CO Nonattainment	Attainment	1983
Topeka (Shawnee)	STSP Nonattainment	Attainment	1985
Part of Kansas City (Wyandotte)	STSP Nonattainment	Attainment	1986
	PTSP Nonattainment	STSP Nonattainment	1986
Lawrence (Douglas)	O_x Nonattainment	Attainment	1986
Part of Kansas City (Wyandotte)		PM_{10} (Group II)[1]	1987
Wichita (Sedgwick)	CO Nonattainment	Attainment	1989
Part of Kansas City (Wyandotte)	STSP Nonattainment	Unclassified	1990

PTSP—Primary TSP
STSP—Secondary TSP

[1] After promulgating the PM_{10} standard in 1987, EPA divided all areas of the country into three categories: (1) areas with a strong likelihood of violating the standard (Group I); (2) areas where attainment of the standards is possible (Group II); and (3) areas with a strong likelihood of attaining the standard (Group III).

Figure 3 illustrates the second maximum 24-hour TSP values for Concordia, Kansas City, Topeka, and Wichita. The second maximum high value is an indicator of a 24-hour standard violation since one exceedance per year is allowed. As illustrated in Table I, the primary 24-hour standard is 260 $\mu g/m^3$ and the secondary is 150 $\mu g/m^3$.

Figure 4 shows PM_{10} data for Concordia, Kansas City, Goodland, and Wichita. Three years are not adequate to establish a trend for PM_{10}; however, comparing PM_{10} with TSP data for 1986 through 1988 suggests that a major portion of the TSP samples are larger than the 10 micron size and, thus, are not likely respirable. None of the PM_{10} samples exceed the 24-hour or annual mean values.

Carbon Monoxide (CO)

Kansas City and Wichita are the two major metropolitan areas in Kansas. Wichita has reported CO exceedances and violations through 1986 but there have been no violations since then. Since neither area has significant stationary CO sources, the CO concentrations measured appear due to mobile sources, i.e., automobiles, trucks, etc. Wichita operated a special purpose monitor for CO at the intersection of Douglas and Main Streets from 1982 through 1988. The results of that monitor are included in Figure 5. No 1-hour exceedances have been recorded in any Kansas location.

Sulfur Dioxide (SO_2)

Except for exceedances of the 24-hour standard in the early 1970s, there have been no reported exceedances of the long- or short-term SO_2 standards. This fact may partly be due to the widespread use of natural gas and fuel oil in most areas of the state. However, efforts are underway by the state and EPA to evaluate attainment in the Kansas City area.

Ozone

The two major metropolitan areas (Kansas City and Wichita) measured ozone standard exceedances in the early and mid-1970s. Few exceedances have been measured in Kansas City, Kansas, during the 1980s; however, ozone exceedances have been measured in the Missouri portion of the interstate region, and the two Kansas counties are major contributors of precursor emissions. Figure 6 shows measured second maximum 1-hour ozone concentrations for Kansas City and Wichita.

Nitrogen Oxides

The NAAQS for nitrogen oxides (NO_x) is 0.053 ppm (100 $\mu g/m^3$) annual arithmetic mean and is both the primary and secondary standard. Nitrogen oxides measurements began reporting in 1974 at numerous locations in Kansas, including Kansas City, Topeka, and Wichita. The measured concentrations found in Kansas are so far below the national standard that EPA authorized the state to discontinue NO_x measurements except in the Kansas City area. NO_x concentrations generally contribute to ozone formation in the presence of VOC and sunlight. Concentrations found in Kansas City are less than half the national standard.

Lead

EPA promulgated the NAAQS for lead on October 5, 1978. The lead standard is 1.5 micrograms per cubic meter ($\mu g/m^3$) and is both the primary and secondary standard. EPA approved the Kansas lead SIP on October 22, 1981. All areas in which lead is monitored show lead concentrations are less than the national standard. Figures 7 and 8 show the quarterly averages for Kansas City and Wichita for the most recent five calendar years.

Summary

With regard to particulate matter concentrations, the most significant reductions in Kansas appear in Kansas City. Comparing PM_{10} values with TSP measurements over the same time period suggests that most TSP is composed of particles greater than 10 microns in diameter. Many areas would have remained nonattainment for the secondary TSP standard; however, PM_{10} measurements show those same areas do not exceed the new PM_{10} standard.

Figure 2 suggests some reductions of the TSP annual mean following the Clean Air Act amendments of 1977. Figure 3 shows significant reductions in the 24-hour concentrations in Topeka and Kansas City, even though they and others show exceedances of the secondary TSP standard. Figure 4 shows no exceedances of the PM_{10} standard.

Wichita and Kansas City are the only Kansas communities that have had significant CO measurements, but only Wichita has exhibited violations of the standard. The federal motor vehicle pollution control program is credited with part of the CO concentration reductions. The remaining reductions are attributed to transportation control activities instituted by the city.

Currently, Kansas City is the only area in the state that is an ozone nonattainment area. Mobile source emissions are a major contributing factor and there are significant VOC stationary sources as well. Automotive emissions have largely been reduced through the federal motor vehicle pollution control program. Stationary sources have been controlled by state and local regulations. The ozone attainment plan for the area was revised in 1986 to provide additional VOC reductions.

The Clean Air Act of 1967 provided funding to start up or expand state air pollution control programs, but the 1970 and 1977 amendments provided the structure needed to develop strong and effective programs. The 1977 amendments contained requirements for areas not attaining the NAAQS to institute more stringent emissions controls to meet the standards, as well as provisions intended to prevent violations in areas with air quality equal to or better than the NAAQS. The Clean Air Act has directly influenced activities which have benefited air quality in Kansas.

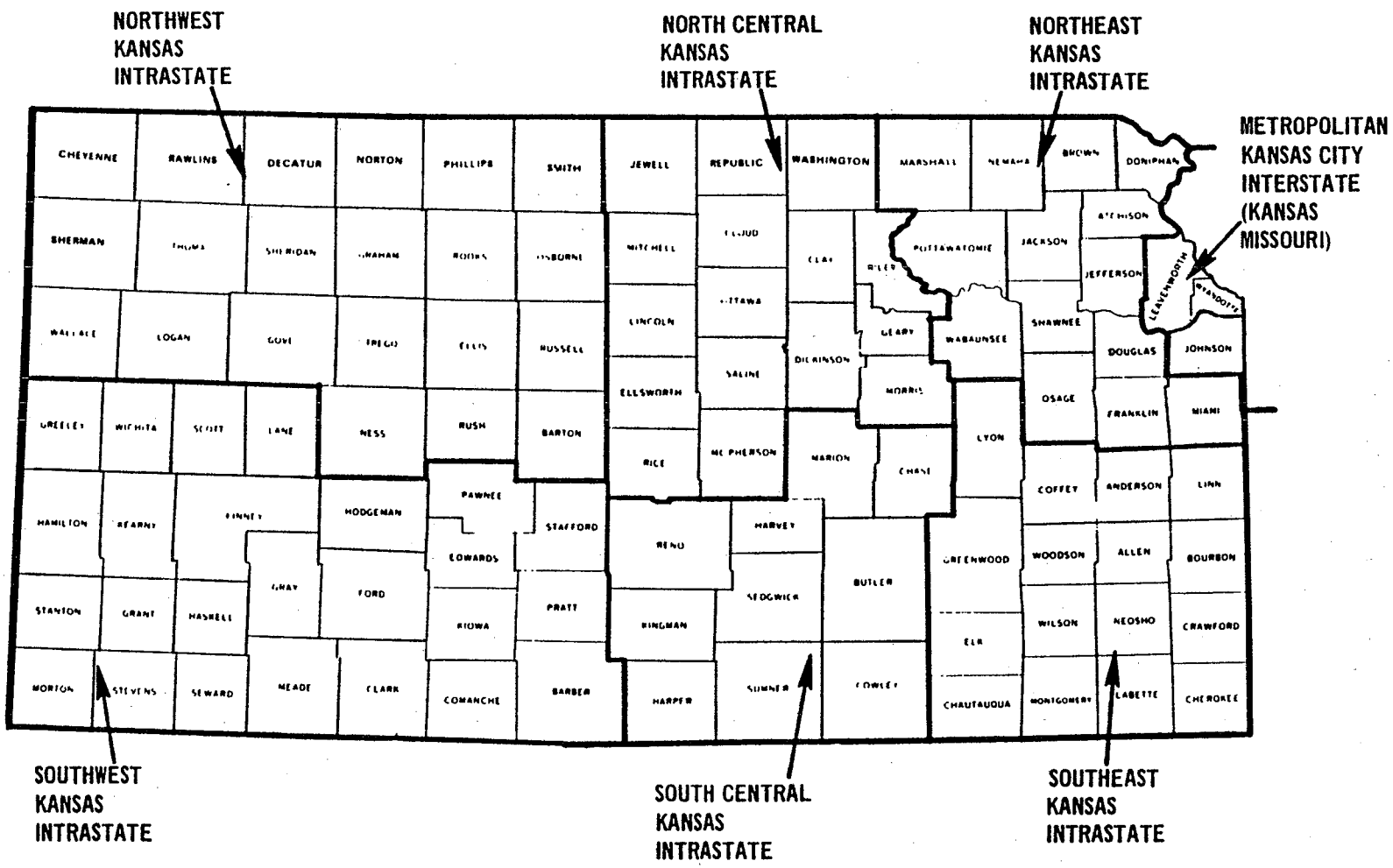
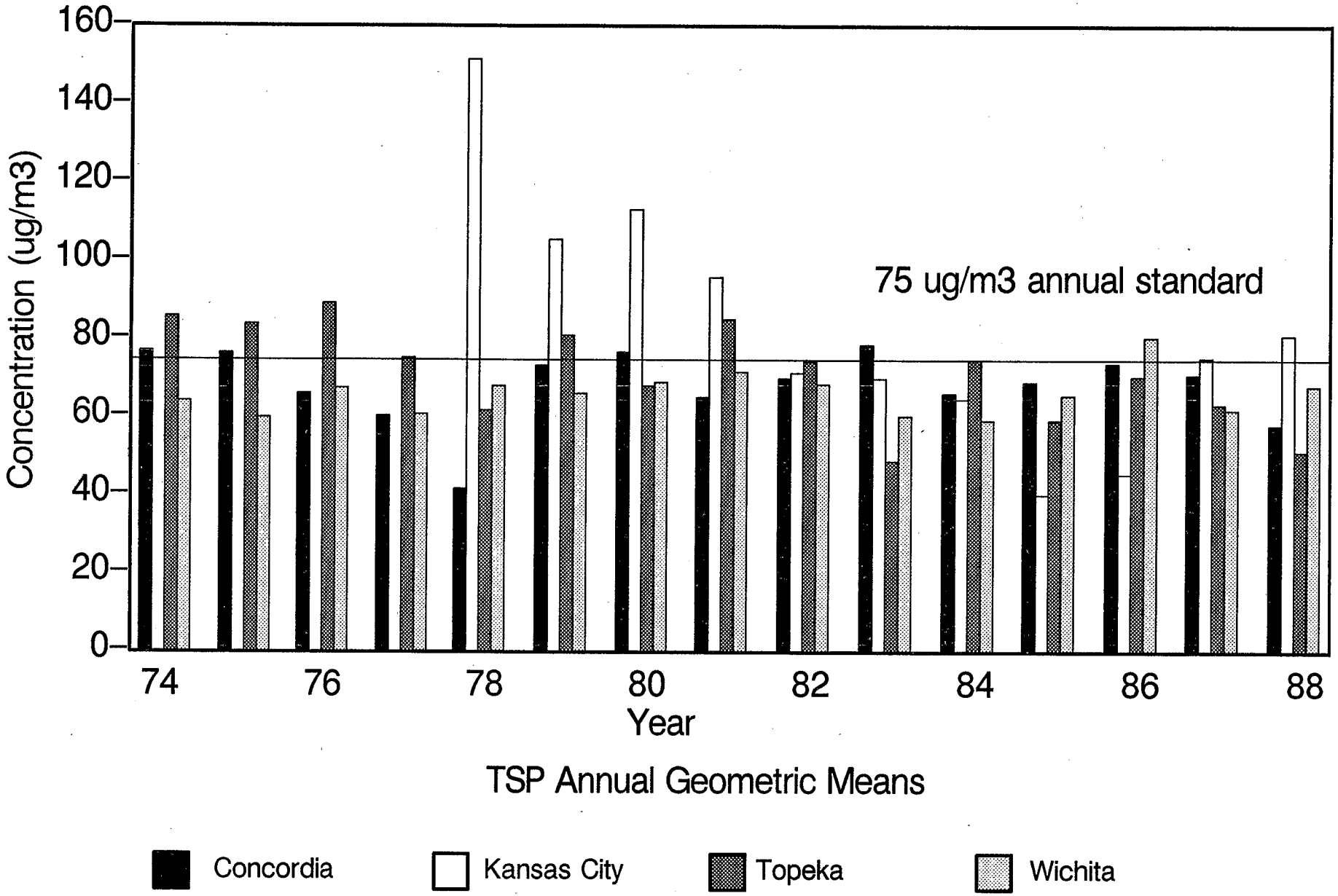


Figure 1. Air Quality Control Regions in Kansas.

FIGURE 2



TSP Annual Geometric Means

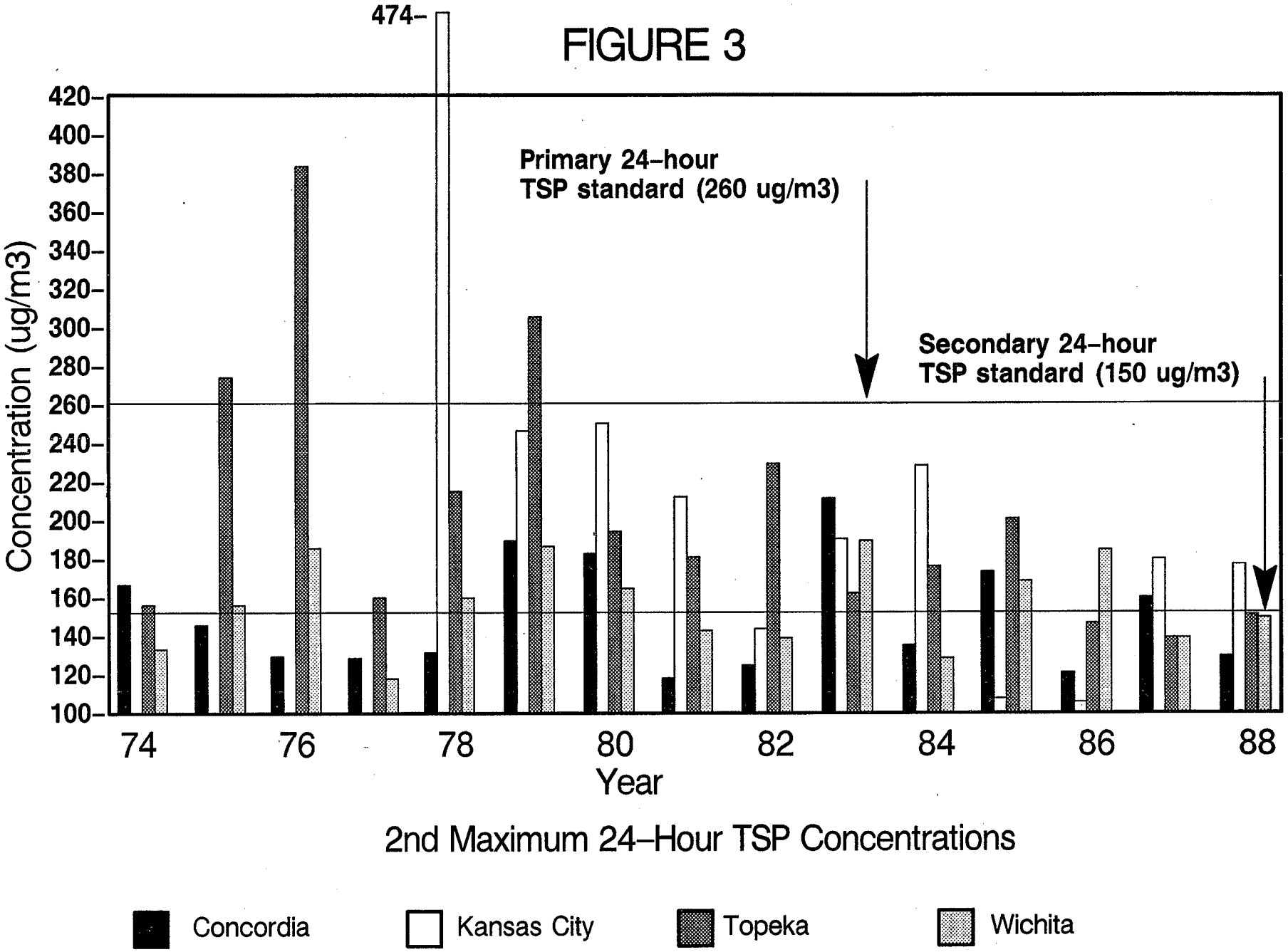


FIGURE 3
474
Primary 24-hour
TSP standard (260 ug/m3)
Secondary 24-hour
TSP standard (150 ug/m3)
Concentration (ug/m3)
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
74
76
78
80
82
84
86
88
Year
2nd Maximum 24-Hour TSP Concentrations
Concordia
Kansas City
Topeka
Wichita

FIGURE 4

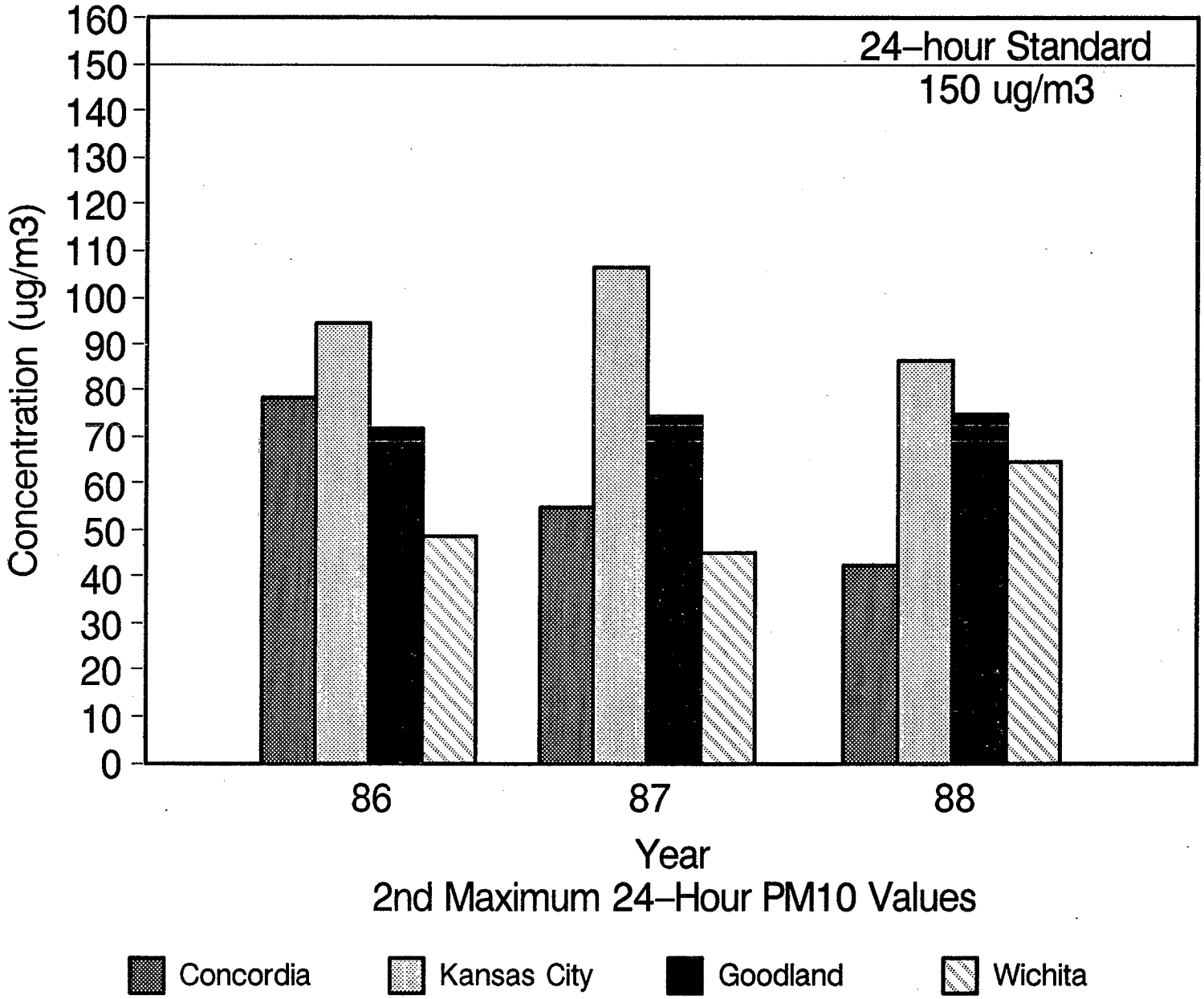
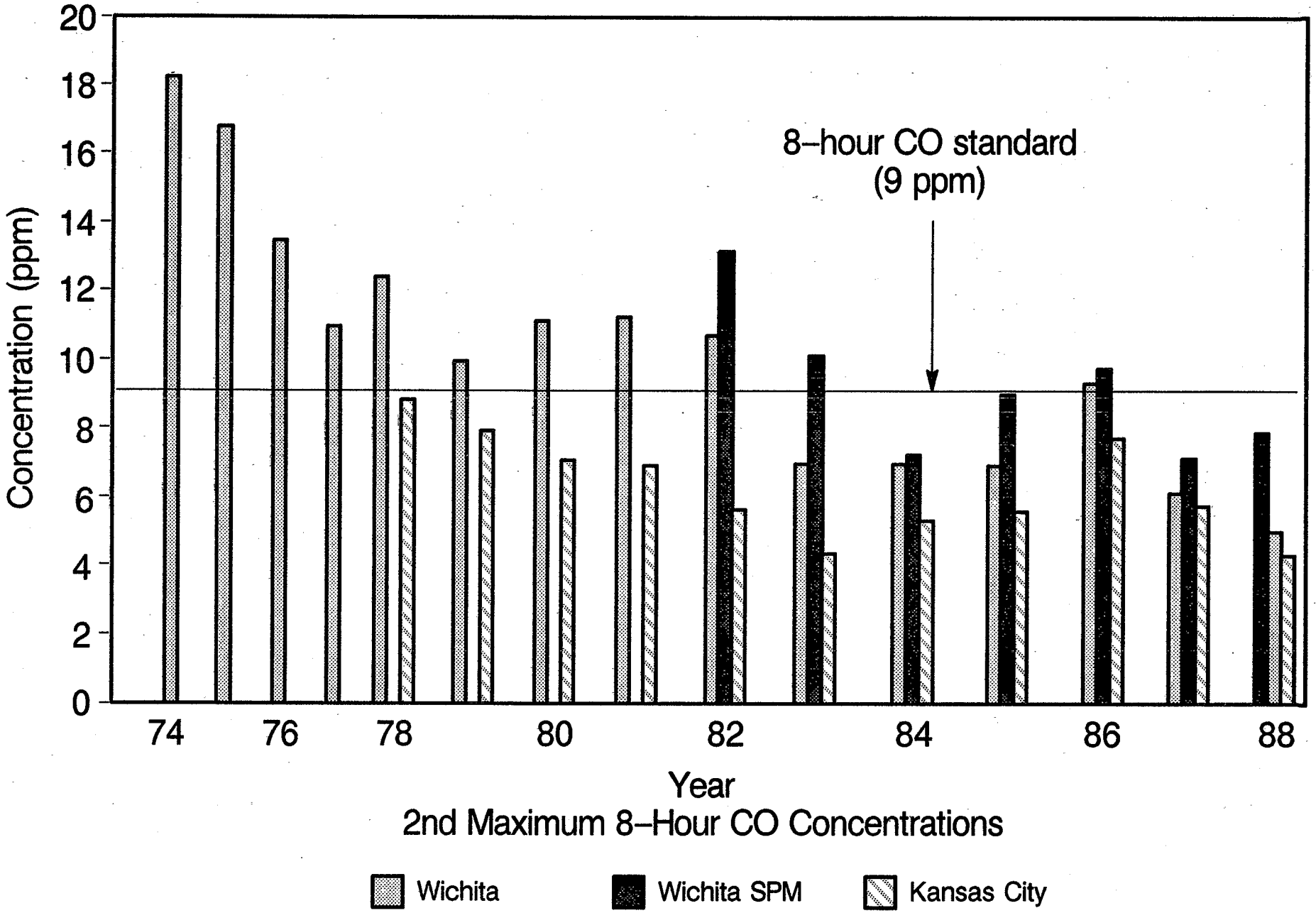
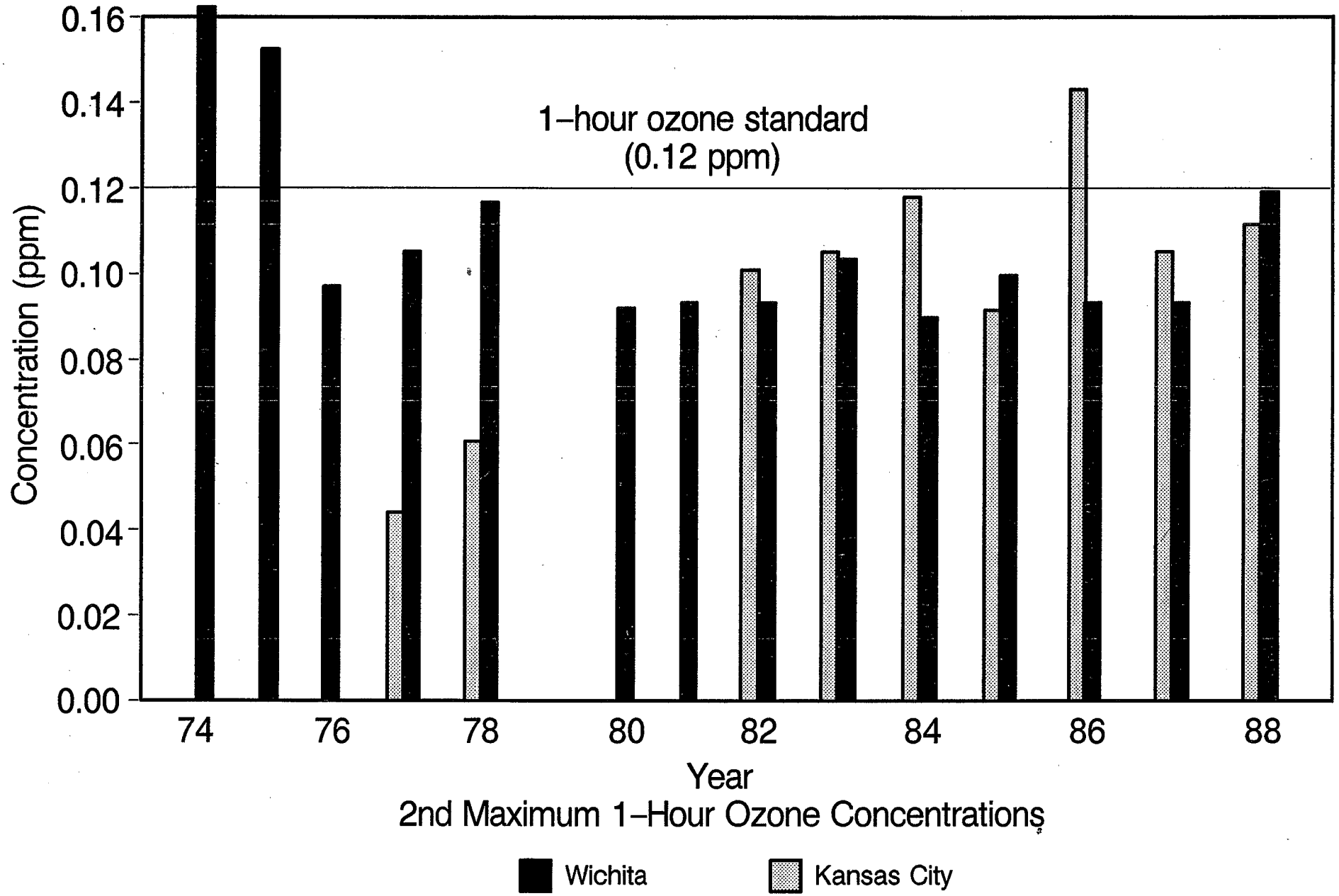

24–hour Standard
150 ug/m3
Concentration (ug/m3)
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
86
87
88
Year
2nd Maximum 24–Hour PM10 Values
Concordia
Kansas City
Goodland
Wichita

FIGURE 5



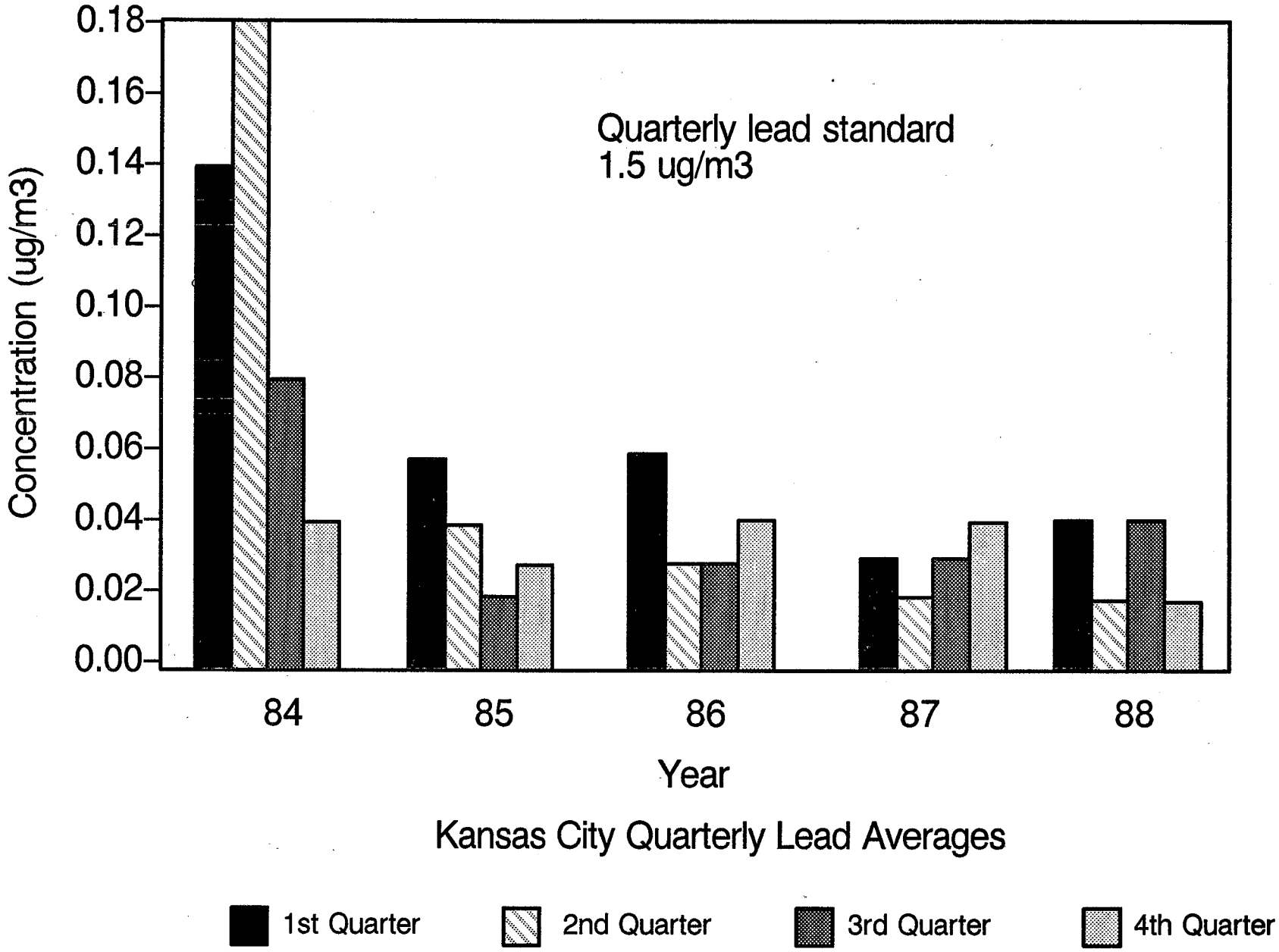
2nd Maximum 8–Hour CO Concentrations

FIGURE 6



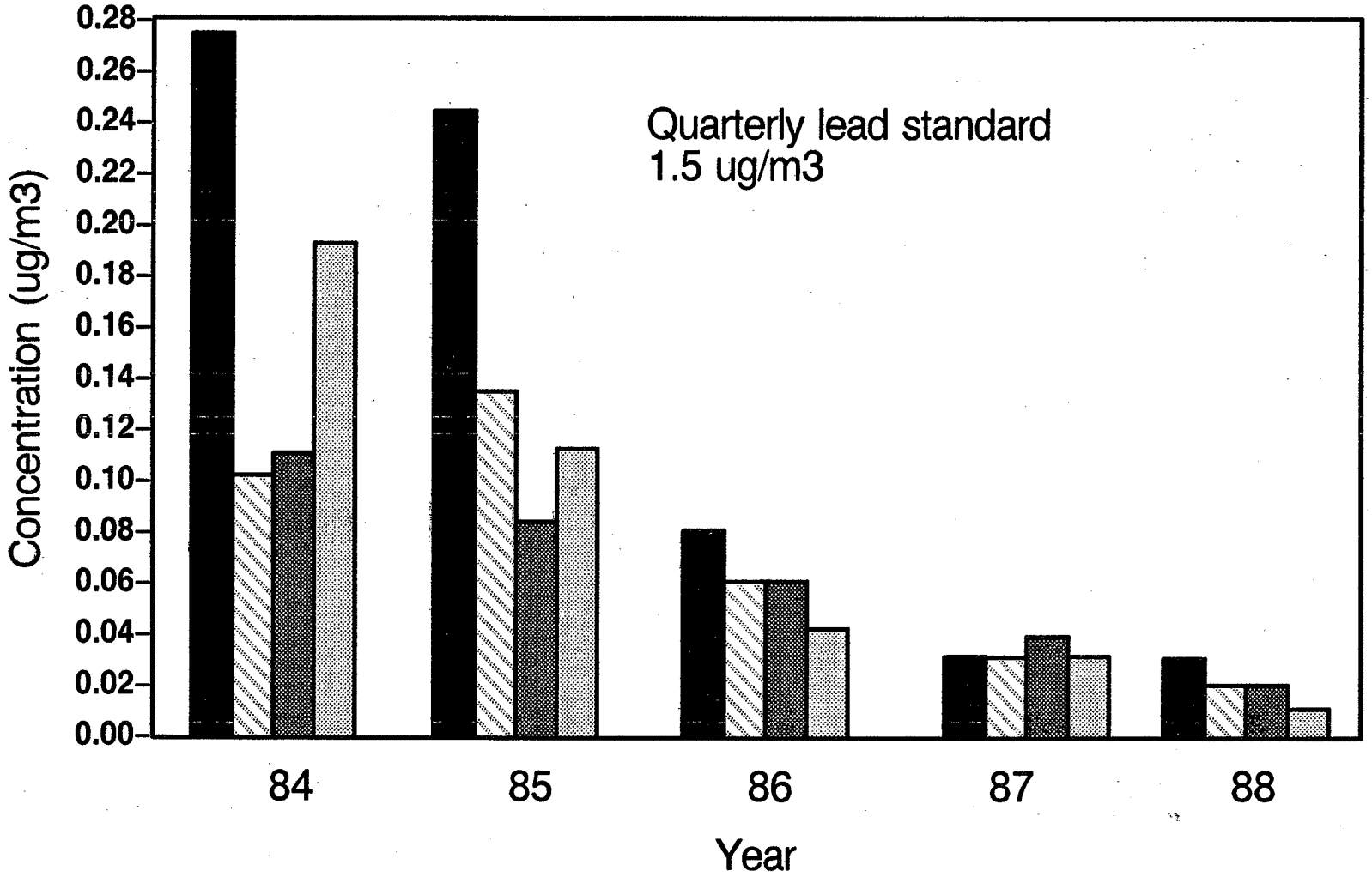
2nd Maximum 1–Hour Ozone Concentrations

FIGURE 7



Kansas City Quarterly Lead Averages

FIGURE 8



Wichita Quarterly Lead Averages

1st Quarter 2nd Quarter 3rd Quarter 4th Quarter