State of Kansas

5-Year Ambient Air Monitoring Network Assessment
July 24, 2020

Our Vision- Healthier Kansans living in safe and sustainable environments.

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Introduction

The U.S. Environmental Protection Agency (EPA) requires each state, or where applicable, local monitoring agencies to conduct network assessments once every five years [40 CFR 58.10(d)].

> *(d) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For PM2.5, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2010.*

The network assessment includes (1) re-evaluation of the objectives for air monitoring, (2) evaluation of a network's effectiveness and efficiency relative to its objectives and costs, and (3) development of recommendations for network reconfigurations and improvements.

This assessment details the current monitoring network in Kansas for the criteria pollutants carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). The monitoring sites are categorized by the following types: NCore (national trend sites), SLAMS (state and local air monitoring sites), SPM (special purpose monitors), and $PM_{2.5}$ speciation sites (trend and State). Specific site information includes location information (address and latitude/longitude), site type, objectives, spatial scale, sampling schedule, and equipment used.

Kansas Weather

Kansas experiences four distinct seasons because of the state's geographical location in the center of the country. Cold winters and hot, dry summers are the norms for the state. The other constant in Kansas weather is the wind. Kansas ranks high in the nation in average daily wind speed. In 2019, the average wind speed across the state was almost 11 miles per hour. The predominant wind direction was from the south. The wind roses in Appendix A show wind speed and direction from meteorological sites in Goodland, Dodge City, Topeka, Wichita, Kansas City, and Chanute. Each "petal" of the wind rose shows the predominant direction from which the wind is blowing. These factors combine to affect the two major areas of air quality concern in the state, ozone and particulate matter.

The air pollution meteorology problem is a two-way street. The presence of pollution in the atmosphere may affect the weather and climate. At the same time, the meteorological conditions greatly affect the concentration of pollutants, as well as the rate of dispersion of pollutants, at a particular location.

The ground-level ozone (smog) problem develops in Kansas during the period from March through October. Ozone is formed readily in the atmosphere by the reaction of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) in the presence of heat and sunlight, which are most abundant in the summer months. Kansas tends to experience ozone episodes in the summer, especially in the large metropolitan areas, when high pressure systems stagnate over the area which leads to cloudless skies, high temperatures, and light winds. Another element of these high pressure systems that contributes to pollution problems is the development of upper air inversions. This will typically "cap" the atmosphere above the surface and not allow the air to mix and disperse pollutants. Therefore, pollution concentrations may continue to increase near the ground from numerous pollution sources since the air is not mixing within and above the inversion layer.

The other pollutant of concern mentioned earlier is particulate matter. Kansas has a long history of particulate matter problems caused by our weather. The Great Dust Bowl of the 1930s was caused in part by many months of minimal rainfall and high winds. This natural source of PM pollution, although not as bad as in the 1930s, is still a concern today as varying weather conditions across the state from year to year cause soil to be carried into the air and contribute to health problems.

Another source of PM pollution is anthropogenic, generated by processes that have been initiated by humans. These particles may be emitted directly by a source or formed in the atmosphere by the transformation of gaseous emissions such as sulfur dioxide (SO_2) and NO_x. Meteorological conditions also affect how these man-made sources of PM form and disperse. One factor that is common in Kansas that can lead to high pollution episodes is a surface inversion. Like upper air inversions, warmer air just above the surface of the earth forms a surface inversion and caps pollutants below it. These inversions are mainly caused by the faster loss of heat from the surface than the air directly above it. In Kansas, surface inversions are more common in the winter months, but can occur during any season and lead to pollution problems.

Uses of Network Data

Data collected by the Kansas Department of Health and Environment's Bureau of Air (KDHE/BOA) network has various end uses. Data is submitted to EPA's Air Quality System (AQS), which in turn determines whether network site monitors are in compliance with the national ambient air quality standards (NAAQS). AirNow uses PM and ozone data to generate Air Quality Index forecasts. Weather or Not, a private weather forecasting company, collects and reviews air quality data to forecast ozone and $PM_{2.5}$ in Kansas City. The BOA also posts ambient air monitoring data to the following website for dissemination:

http://keap.kdhe.state.ks.us/airvision/
The BOA uses ambient monitoring data for Prevention of Significant Deterioration (PSD) permitting, for special studies, and for planning purposes such as State Implementation Plans (SIPs).

Population Summary

This section addresses the breakdown of overall and Core-Based Statistical Areas in the state of Kansas. There are six Metropolitan Statistical Areas (MSAs), two Combined Statistical Areas (CSAs), and sixteen Micropolitan Statistical Areas (μSAs) in the State of Kansas.

Metropolitan Statistical Areas

The six MSAs in Kansas are Kansas City, MO-KS, Lawrence, Manhattan, St. Joseph, MO-KS, Topeka, and Wichita. The MSAs are defined as follows:

Kansas City, MO-KS MSA

Bates County (MO)
Caldwell County (MO)
Cass County (MO)
Clay County (MO)
Clinton County (MO)
Jackson County (MO)
Johnson County (KS)
Lafayette County (MO)
Leavenworth County (KS)
Linn County (KS)
Miami County (KS)
Platte County (MO)
Ray County (MO)
Wyandotte County (KS)

Lawrence MSA

Douglas County

Manhattan MSA

Pottawatomie County

Riley County
Geary County

St. Joseph, MO-KS MSA
Doniphan County (KS)
Andrew County (MO)
Buchanan County (MO)
DeKalb County (MO)

Topeka MSA
Jackson County
Jefferson County
Osage County
Shawnee County
Wabaunsee County

Wichita MSA
Butler County
Harvey County
Sedgwick County
Sumner County

The Wichita MSA has seen a population increase of 2.21% from 2010 to 2018. In the Wichita MSA, KDHE/BOA has monitors in Sedgwick and Sumner Counties. The Manhattan MSA has seen a population increase of 5.67% from 2010 to 2018. The BOA currently has no monitoring stations in this MSA. The Topeka MSA has seen a population decrease of 0.55% from 2010 to 2018. The BOA has one monitoring site in Shawnee County. The Lawrence MSA has seen a population increase of 9.57% from 2010 to 2018. BOA currently does not have a monitoring site in Douglas County although an ozone monitor ran in this county from 2003 to 2006. The Kansas City MSA has seen a population increase of 6.68% from 2010 to 2018. In the Kansas City MSA, BOA has monitors in Leavenworth, Johnson, and Wyandotte Counties. The U.S. Census Bureau 2010–2018 population change data of these MSAs is shown in Appendix B.

Combined Statistical Areas

The two CSAs in Kansas are Kansas City-Overland Park-Kansas City, MO-KS CSA and Wichita-Arkansas City-Winfield, KS CSA. The CSAs are defined as follows:

Kansas City-Overland Park-Kansas City, MO-KS CSA
Atchison, KS μSA
Kansas City, MO-KS MSA
Lawrence, KS MSA
Ottawa, KS μSA
St. Joseph, MO-KS MSA
Warrensburg, MO μSA

Wichita-Winfield, KS CSA
Winfield, KS µSA
Wichita, KS MSA

The Kansas City-Overland Park-Kansas City, MO-KS CSA has seen a population increase of 6.15% from 2010 to 2018. The KDHE/BOA operates three monitoring sites in this CSA. The Wichita-Winfield, KS CSA has seen a population increase of 2.04% from 2010 to 2018. The BOA operates 3 monitoring sites in this CSA. The U.S. Census Bureau 2010–2018 population change data of these CSAs is also shown in Appendix B.

Micropolitan Statistical Areas

KDHE operates monitors in two micropolitan statistical areas, Dodge City and Salina. The sixteen µSAs in Kansas are defined as follows:

Atchison µSA***
Atchison County
Coffeyville µSA***
Montgomery County

Dodge City µSA
Ford County

Emporia µSA***
Lyon County
Chase County

Garden City µSA***
Finney County
Kearny County

Great Bend µSA***
Barton County

Hays µSA***
Ellis County

Hutchinson µSA***
Reno County

Junction City µSA***
Geary County

Liberal µSA***
Seward County

McPherson µSA***
McPherson County

Ottawa µSA***
Franklin County

Parsons µSA***
Labette County

Pittsburg µSA***
Crawford County
Salina µSA
Ottawa County
Saline County

Arkansas City -Winfield µSA***
Cowley County

******* The KDHE/BOA does not operate any monitors in these µSAs.

The U.S. Census Bureau 2010-2018 population change data of these µSAs is shown in Appendix C.

Anticipated Growth/Decline

According to the U.S. Census Bureau, the growth or decline of these two Combined Statistical Areas (CSAs), six Metropolitan Statistical Areas (MSAs), and sixteen Micropolitan Statistical Areas (µSAs) is anticipated to maintain a similar trend over the next several years.

Kansas Criteria Pollutant Emissions Trends

Emissions of criteria pollutants in Kansas continue to decrease as vehicles become cleaner and as facilities become more efficient and install controls. Figure 1 shows historic and recent criteria pollutant emissions (tons) in the EPA's NEI database from 2008 to 2016. In general, emissions in both the onroad and nonroad mobile sectors continue to decrease as tougher fleet emission standards and fuel requirements are implemented on the federal level. Point source emissions have also decreased for most pollutants during this time period, with major decreases in NO_x and SO_2 emissions.

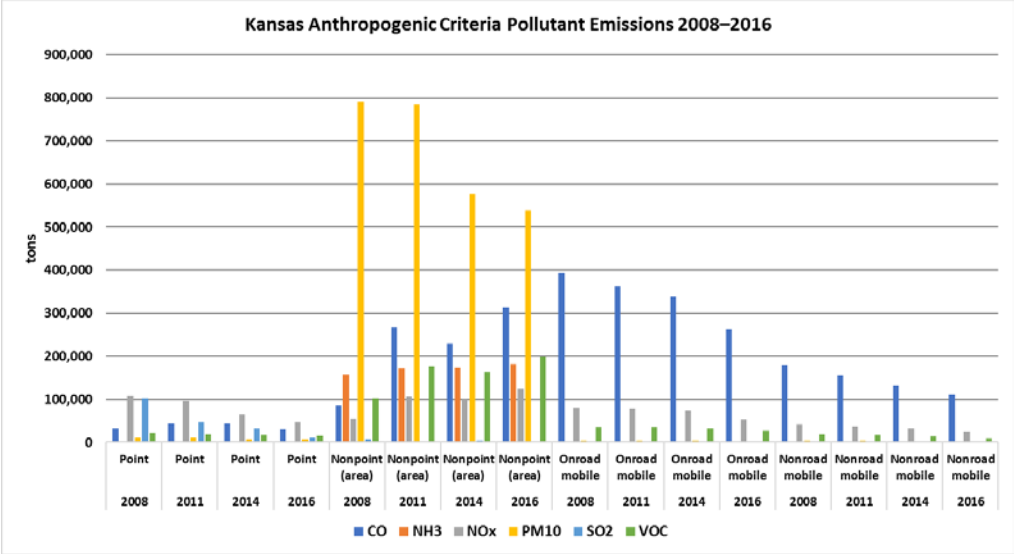


Figure 1. Kansas Criteria Pollutant Emissions 2008–2016 (tons)

Source: EPA National Emissions Inventory (NEI) (http://www.epa.gov/ttn/chief/eiinformation.html)

As can be seen in Figure 1, nonpoint or area sources continue to be the largest sources of emissions in the state. The large area source particulate matter (PM_{10}) emissions can mostly be attributed to unpaved road dust in the state. Kansas conducts an annual point source inventory of permitted sources in the state. The annual inventory covers both permitted Title V facilities and synthetic minor facilities, which take a permit limit to avoid a Title V permit. Figure 2 below shows the trend in emissions from 2009–2018. As one can see from the figure, point source emissions have all generally trended down over the years, especially for NO_x and SO_2. The slight NO_x and carbon monoxide (CO) increase between 2017 and 2018 can be attributed to the natural gas usage explosion across the country. The KDHE inventory lists several substantial increases in emissions from gas compressor stations located primarily in the southwest corner of the state. In addition, there were also slight increases in the emissions from the state's largest electrical generating units (EGUs). There has been a slight decrease in volatile organic compounds (VOCs), while PM_{10}, ammonia (NH_3) and hazardous air pollutant (HAP) emissions have remained level between 2009–2018.

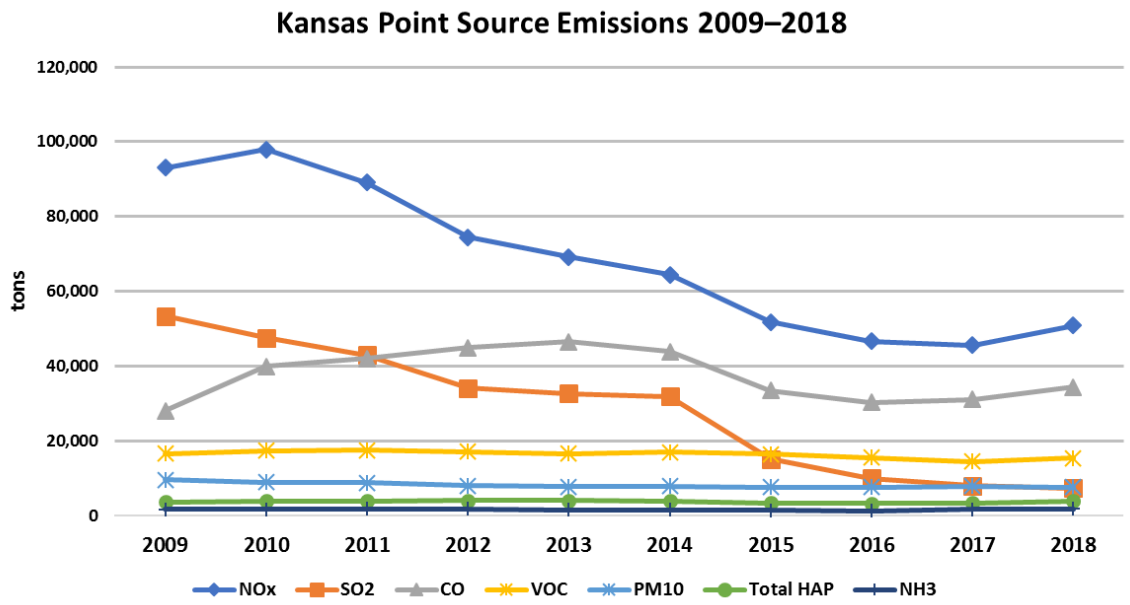


Figure 2. Point Source Emissions Trends 2009-2018

Source: KDHE State and Local Emissions Inventory System (SLEIS) Database

Current Criteria Emissions in Kansas

Particle pollution is a general term used for a mixture of solid particles and liquid droplets found in the air. EPA regulates particle pollution as $PM_{2.5}$ (fine particles) and PM_{10} (all particles 10 micrometers or less in diameter).

$PM_{2.5}$ emission densities correlate closely with large facilities, populated areas, and areas in the Flint Hills where burning occurs. KDHE expects direct $PM_{2.5}$ emissions to remain consistent in the near term. Secondary formation of $PM_{2.5}$ will likely continue to decrease as emissions of NO_x and SO_x continue to decrease. Generally, the secondary $PM_{2.5}$ will be formed in upwind counties (and states) and be transported downwind. This transport can occur over large distances.

PM_{10} emissions densities track closely with population centers. This correlation includes both the residential and industrial processes as well as the mobile component. Much like $PM_{2.5}$, KDHE anticipates PM_{10} emissions will remain nearly flat into the near future.

Carbon monoxide (CO) is a colorless and odorless gas formed when carbon in fuel is not burned completely. CO emission densities track population centers very closely. Because CO is a function of fossil fuel combustion, the residential, commercial, and industrial component, along with the mobile portion, drives the CO emissions. The slight rise in CO values between 2017 and 2018 are attributed to the explosion of natural gas usage across the country and the increase in the gas compressor stations located in Kansas. KDHE anticipates CO emissions will level off and remain constant throughout the coming years.

Ground level ozone is the pollutant of concern that necessitates tracking emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Ozone forms when VOCs and NO_x react in the presence of sunlight. These constituents come from anthropogenic sources such as motor vehicle exhaust, power plant and industrial emissions, gasoline and chemical solvent vapors, and from natural sources.

Nitrogen dioxide (NO_2) is the primary member of the nitrogen oxides (NO_x) group of gases. It is formed in the air through the oxidation of nitric oxide (NO) emitted when fuel is burned at a high temperature. NO_x emission densities are higher in counties with large EGUs, numerous gas compressor stations, or those counties with a large population. Kansas has several large power plants that make up a significant portion of the total NO_x emissions in the state. Many of these power plants have significantly reduced their NOx emissions in the last 10 years. In the Kansas City area, a NO_x RACT rule went into place in June 2010 after contingency measures for ozone were triggered. These RACT rules further decreased NO_x emissions in this area.

VOC emissions densities are associated with both population centers and the Flint Hills area in Kansas where prescribed burning occurs. The overall trend in point source VOC emissions has been a decrease as various controls over the years have reduced these emissions. KDHE anticipates VOC emissions from the point sector will remain flat over the coming years. VOC emissions associated with burning will vary from year to year as the number of acres burned varies from year to year. VOC is a precursor pollutant for ozone.

Sulfur dioxide (SO_2), the primary component of the sulfur oxides (SO_x) group of gases, is formed from burning fuels containing sulfur (e.g., coal or distillate oil), or from the petroleum refining process. SO_2 dissolves in water vapor to form acid and can interact with NH_3 and particles to form sulfates. SO_x emissions densities generally reflect the location of the coal-fired power plants within the state. The state's nine coal-fired EGUs, three petroleum refineries, and one carbon black manufacturing plant are the largest sources of SO_x emissions in Kansas. Like NO_x emissions, the trend is downward for this pollutant. KDHE saw significant reductions in SO_2 beginning in 2007 as scrubbers were installed and operated on the largest coal-fired power plants within the state. There was a significant decrease of SO_2 emission at Jeffrey Energy Center, the largest SO_2 emission source in the state, between 2008 and 2009.

Ammonia (NH_3) emissions densities in Kansas are most strongly associated with confined animal feeding operations and fertilizer application. NH_3 is a precursor to secondary sulfate and nitrate particulate formation. KDHE anticipates NH_3 emissions will remain consistent over the next few years and will continue to remain strongly associated with agricultural related activities.

Appendix D contains the latest (2018) emission inventory for individual sources in the state and a map of all Title V and PSD permitted facility source locations in the state.

Appendix E contains emissions density (tons per square mile) plots on a county basis for Kansas. The emissions densities were calculated using EPA's base year 2016 modeling inventory, developed in collaboration with states for regional haze and ozone future year emissions estimates (ref: https://www.epa.gov/air-emissions-modeling/2016v1-platform). Appendix E maps include all anthropogenic emissions categories, with the exception of agricultural and road dust particulate matter. As well, biogenic emissions are not included in these maps. As one would expect, emissions (except ammonia) are generally higher in heavily populated counties or in counties that have large emitting facilities such as power plants. Ammonia emissions, which are characteristic of fertilizer application and animal waste activities, are generally higher in the southwest portion of the state.

Ozone Monitoring Network

Current Ozone Standard and Monitoring Requirements

EPA is conducting a review of the ground-level ozone (O_3) national ambient air quality standards (NAAQS) for the primary and secondary standards. A review of the standard is required every five years. The review and identified changes to the air quality standard for ozone are largely based on evidence of the effects of ozone on public health and the environment. EPA uses three years of monitoring data to determine if an area meets the primary and secondary standards. An area meets the standards if the 4th highest maximum daily 8-hour ozone concentration each year, averaged over three years, is 70 ppb or below.

Kansas Air Monitoring Network for Ozone

Table 1 contains the list of Kansas sites with ozone monitoring equipment, nine in total. Ground-level ozone is measured year-round with seasonal reporting starting on March 1 and ending October 31 of each year. Table 1 also lists the site locations and the spatial scale of the measurement. Sites are situated to measure population exposure as an overarching objective. The scale of the measurement varies by site per requirement.

Table 1. Sites Measuring Ground-Level Ozone in Kansas

Site Name	Site ID	Latitude	Longitude	Address/location	Spatial scale
Cedar Bluff	20-195-0001	38.770081	-99.763424	Pronghorn & Muley, Brownell (Cedar Bluff Reservoir)	Regional
Chanute	20-133-0003	37.676960	-95.475940	1500 W 7th St	Neighborhood
Heritage Park	20-091-0010	38.838575	-94.746424	13899 W 159th St, Olathe (Heritage Park)	Neighborhood
JFK/NCore	20-209-0021	39.117219	-94.635605	1210 N 10th St, Kansas City (JFK Rec. Center)	Urban
KNI	20-177-0013	39.024265	-95.711275	2501 Randolph Ave, Topeka	Neighborhood
Leavenworth	20-103-0003	39.327391	-94.951020	2010 Metropolitan	Neighborhood
Peck	20-191-0002	37.476890	-97.366399	707 E 119th St S (Peck Community Bldg.)	Regional
Sedgwick	20-173-0018	37.897506	-97.492083	12831 W 117th St N	Urban
Wichita Health Dept.	20-173-0010	37.702066	-97.314847	1900 E 9th St (Health Dept.)	Urban

Figure 3 shows the population density of the state in relation to sites measuring ground-level ozone. States are required to operate monitoring sites in areas largely based on population, therefore MSAs with higher population densities have more monitoring sites, per requirement. The Wichita MSA includes the counties of Butler, Harvey, Sedgwick, and Sumner, and the sites Sedgwick, Wichita Health Dept., and Peck measure ozone levels for this area. Likewise, the Kansas City MSA includes the counties of Leavenworth,

Wyandotte, Johnson, Miami, and Linn on the Kansas side. The sites Heritage Park, Leavenworth, and JFK/NCore measure ozone levels for this area.

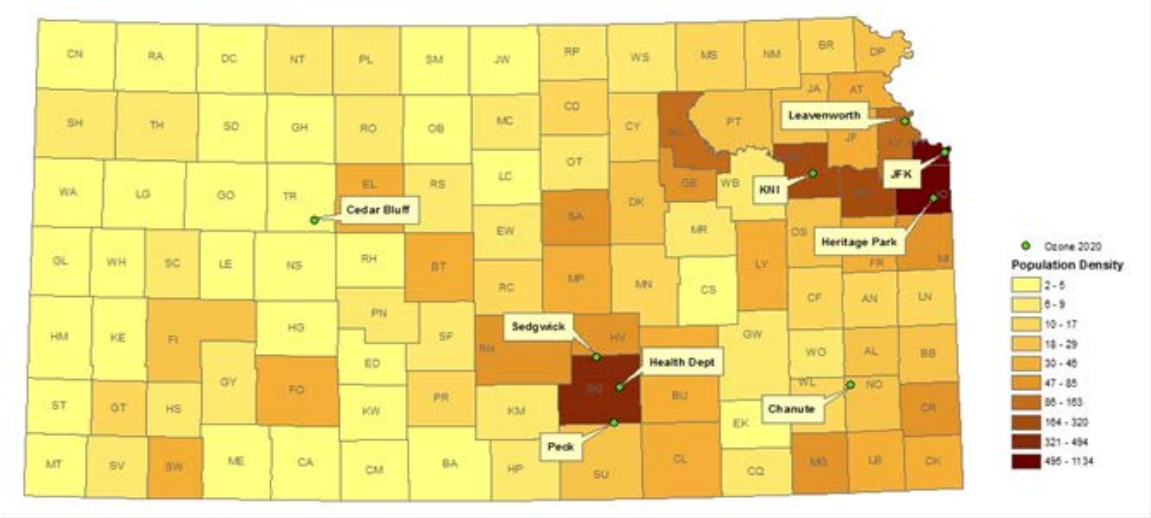


Figure 3. Kansas Population Density Map with Ozone Monitor Locations

Ozone Measurements Trend Analysis

30-day rolling averages of the daily maximum 8-hour O_3 concentrations during 2015–2018 are presented in Figures 4, 5, and 8. Meteorological conditions affect ozone formation; emissions of VOCs and NO_x mix during the daytime and the reaction intensifies when temperatures are elevated. Therefore, ozone concentrations are elevated in late spring and summer. Lower concentrations are observed in fall and winter due to lower temperatures and fewer hours of daylight. Ground-level ozone is often described as a seasonal pollutant.

Figure 4 includes measurements from monitoring sites in Leavenworth, Olathe (Heritage Park), and Kansas City, KS. Ozone concentrations at these sites show similar magnitude of concentration and track consistently during the 4-year period. Elevated concentrations were observed in summer and lower concentrations appear during the winter season as expected. There are a few notable observations. Multiple spikes are observed during the ozone season (March 1 – October 31) each year; the spikes do not necessarily appear at the same time from year to year since summer ozone concentrations are substantially affected by meteorological conditions, especially ambient temperature, cloud coverage, humidity, and precipitation. However, each year the very first distinguishable spikes appear in April. There is a high probability that significant contributions to these spikes are from the annual prescribed burn activities occurring in the Flint Hills area. This routine agricultural process, carried out to preserve the tall grass prairie ecosystem, occurs approximately 120 miles west of the Kansas City area. Ozone and ozone constituents VOCs and NOx are carried to downwind areas where concentrations are measured at higher than expected levels. Also notably, the data show that the measurements at JFK/NCore observed lower O_3 concentration in winter in comparison with the other measurements in Olathe and Leavenworth. This was likely caused by the slower rate of O_3 production in winter due to fewer hours of sunlight and lower temperatures, combined with O_3 consumption by NO_x in an urban area (JFK/NCore) where NO_x is readily available.

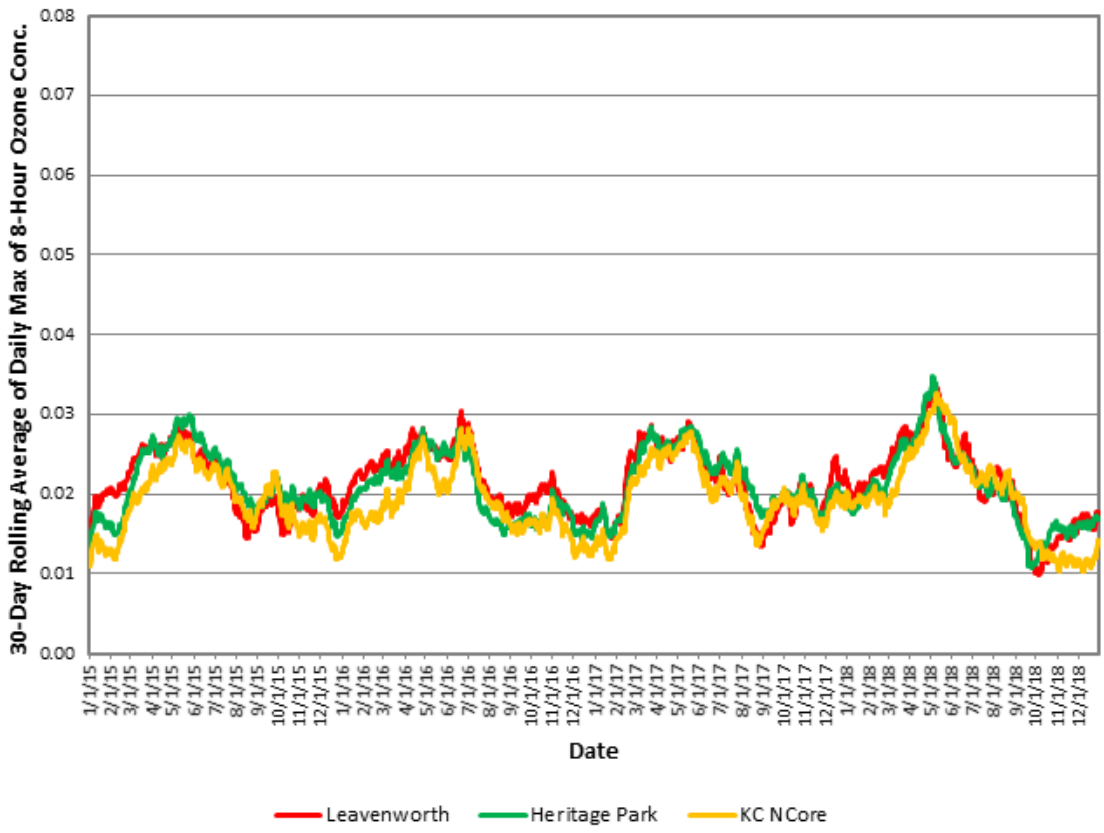


Figure 4. 30-day Rolling Average of Daily Max. 8-hr O_3 Concentrations at Monitors in and near Kansas City, KS 2015–2018

The 30-day rolling averages of the daily maximum 8-hour O_3 concentrations in or near Wichita are presented in Figure 5. The Wichita Health Department site has been operating at the present location since 1973. The site located in Peck, KS has been operating since 1999. The site at Sedgwick, KS has been operating since 2008. Wichita Health Department is the urban center site located in downtown Wichita; the Peck monitor is located to the south-southwest of the Wichita Health Department monitor, measuring regional O_3 transport into Wichita; and the Sedgwick monitor is located to the northwest of Wichita, measuring O_3 concentrations transported through the city of Wichita.

Measurements from all three monitors show the expected seasonal pattern with regard to ozone concentrations. The site at Wichita Health Department experienced data loss between 5/30/2017 and 7/16/2017 due to quality control issues. Discernable spikes starting in April each year indicate that ozone precursors in smoke from prescribed burn activities in the Flint Hills region have impacts on Wichita area monitors. The April peaks in Wichita do not show the same pattern as those in Kansas City. One explanation is that prevailing wind direction determines the area which the burning affects. April 2015–2018 wind roses for the Wichita Dwight D. Eisenhower National Airport Automated Surface Observing System (ASOS) and the Kansas City, MO Charles B. Wheeler Downtown Airport ASOS sites are shown in Figures 6 and 7. Presented in a circular format, the wind rose shows the

frequency of winds blowing from particular directions over a specified period. The length of each "spoke" around the circle is related to the frequency that the wind blows from a particular direction per unit time. Each concentric circle represents a different frequency, emanating from zero at the center to increasing frequencies at the outer circles. A wind rose plot may contain additional information, in that each spoke is broken down into color-coded bands that show wind speed ranges. Wind roses typically use 16 cardinal directions, such as north (N), NNE, NE, etc., although they may be subdivided into as many as 32 directions. In terms of angle measurement in degrees, North corresponds to 0°/360°, East to 90°, South to 180°, and West to 270°.

Kansas City and Wichita are in different directions with respect to the Flint Hills region; therefore, it is less likely that the O_3 concentrations at both of these areas are significantly impacted by the burning activities at the same time.

Figure 5. 30-day Rolling Average of Daily Max. 8-hr. Ozone Concentrations at Monitors in or near Wichita 2015–2018

Wind roses show that prevailing winds at the Wichita site in April are predominantly from the south-southeast, while wind directions at the Kansas City site are more variable. Because Wichita is located to the west of the Flint Hills region, smoke impacts usually occur if the winds are out of the east or southeast. On the other hand, Kansas City is located farther east of the Flint Hills and is impacted more when the winds blow from the west or southwest. Kansas City is also located farther east of the actual geographical area of the Flint Hills.

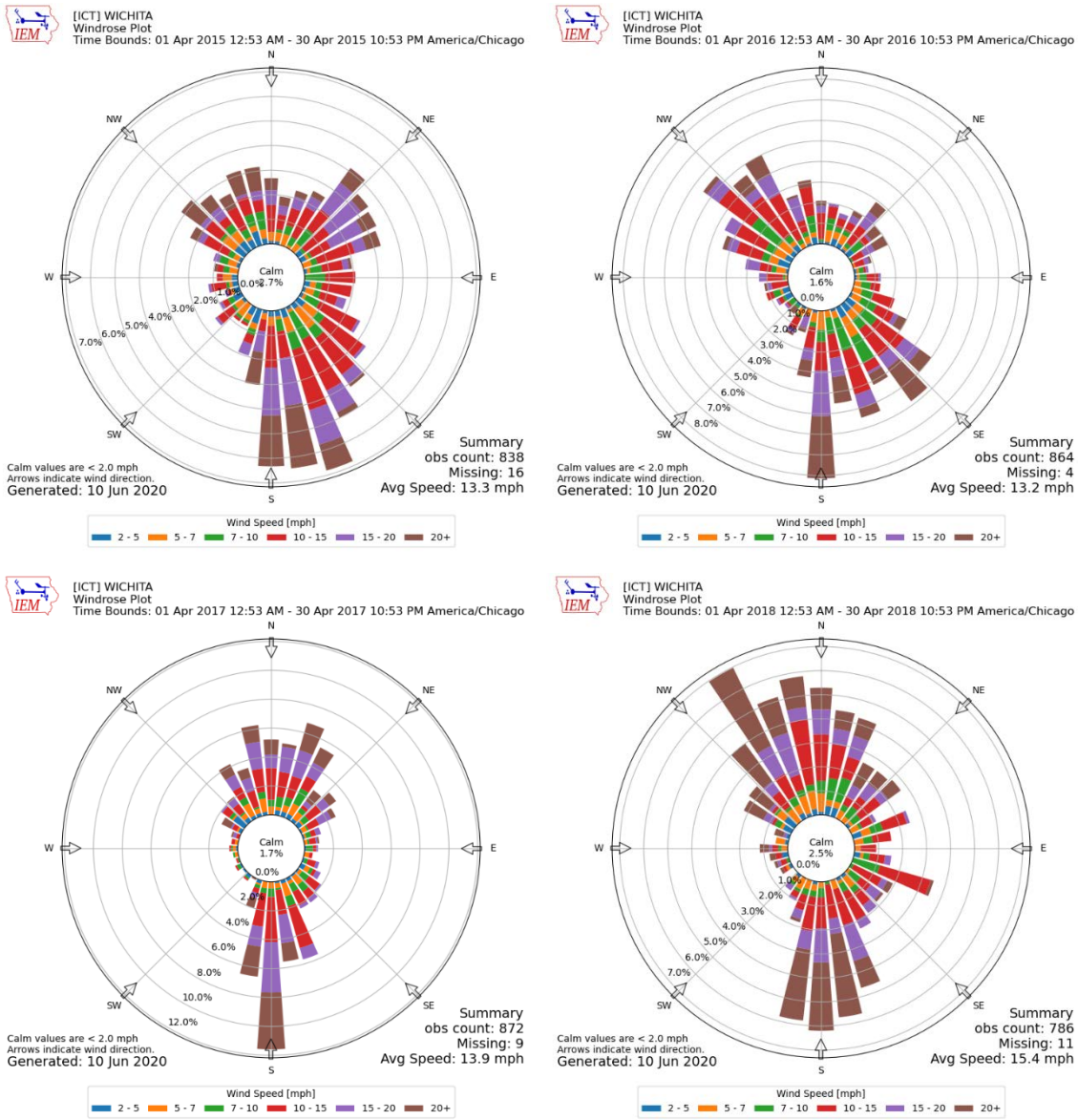


Figure 6. Wichita Dwight D. Eisenhower National APT ASOS Wind Rose April 2015–2018

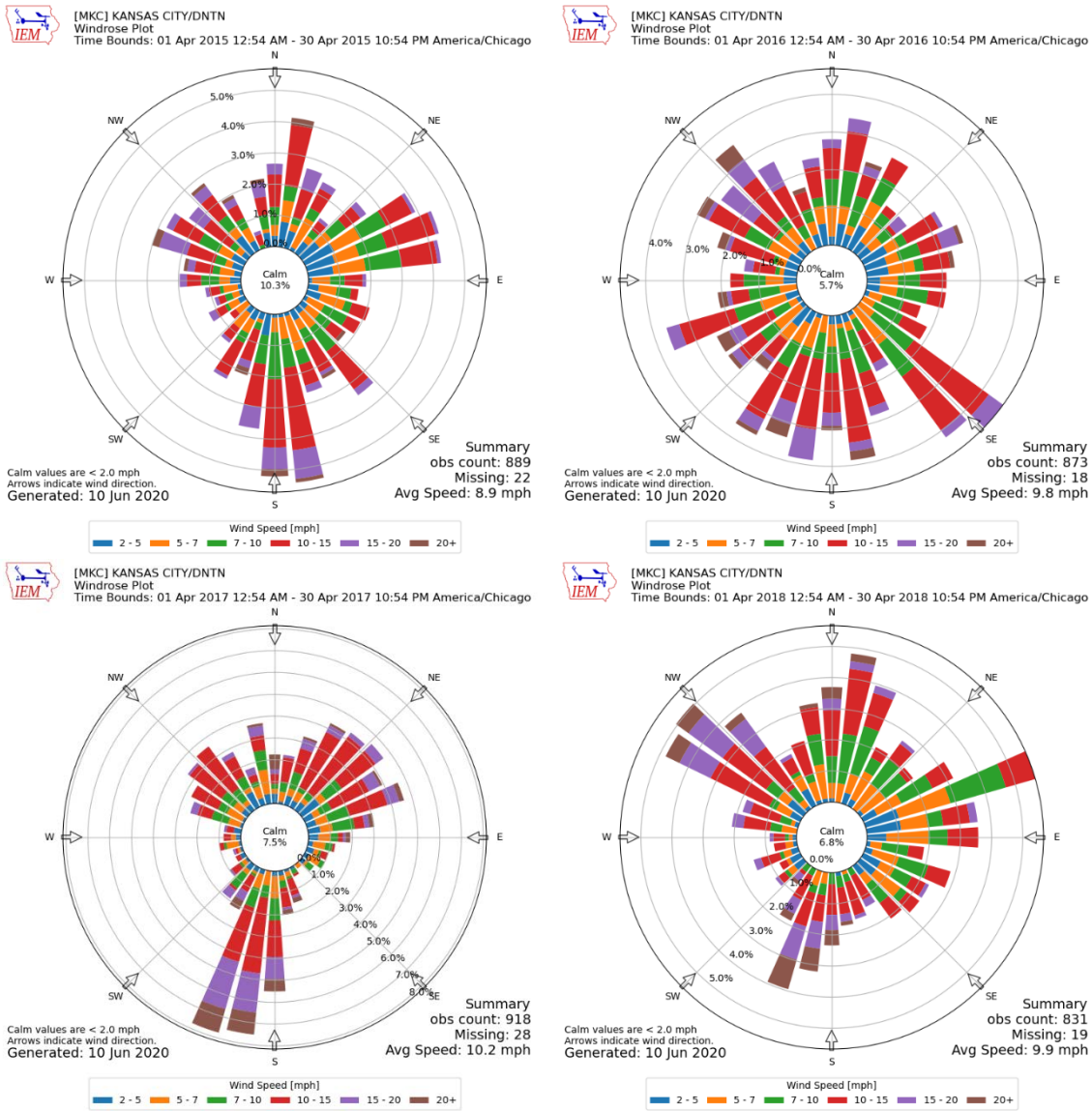


Figure 7. Kansas City, MO Charles B. Wheeler Downtown APT ASOS Wind Rose 2015–2018

Measurements of the other three Kansas O_3 monitors are shown in Figure 8. The KNI site in Topeka has been operating since late 2006. The Chanute monitoring site began operations in 2014. As of 2000, the Cedar Bluff site continues to operate as the comprehensive background site in the Kansas Air Monitoring Network.

Again, measurements from all three monitors show the expected seasonal pattern with regard to ozone concentrations. It is noteworthy that the 30-day rolling averages of daily maximum 8-hour O_3 concentrations at Cedar Bluff have been higher than both KNI and Chanute. It is expected that a site located to measure background pollutants levels would show the lowest concentrations. Cedar Bluff is located at Cedar Bluff State Park in Trego County, and there are no significant emission sources located near the site. Extensive oil and gas operations in Kansas, Texas, and Oklahoma could be contributing to the elevated

readings at Cedar Bluff, but this has not been significantly analyzed. The measured concentrations at Cedar Bluff could also indicate that the background O_3 levels in Kansas are higher than expected.

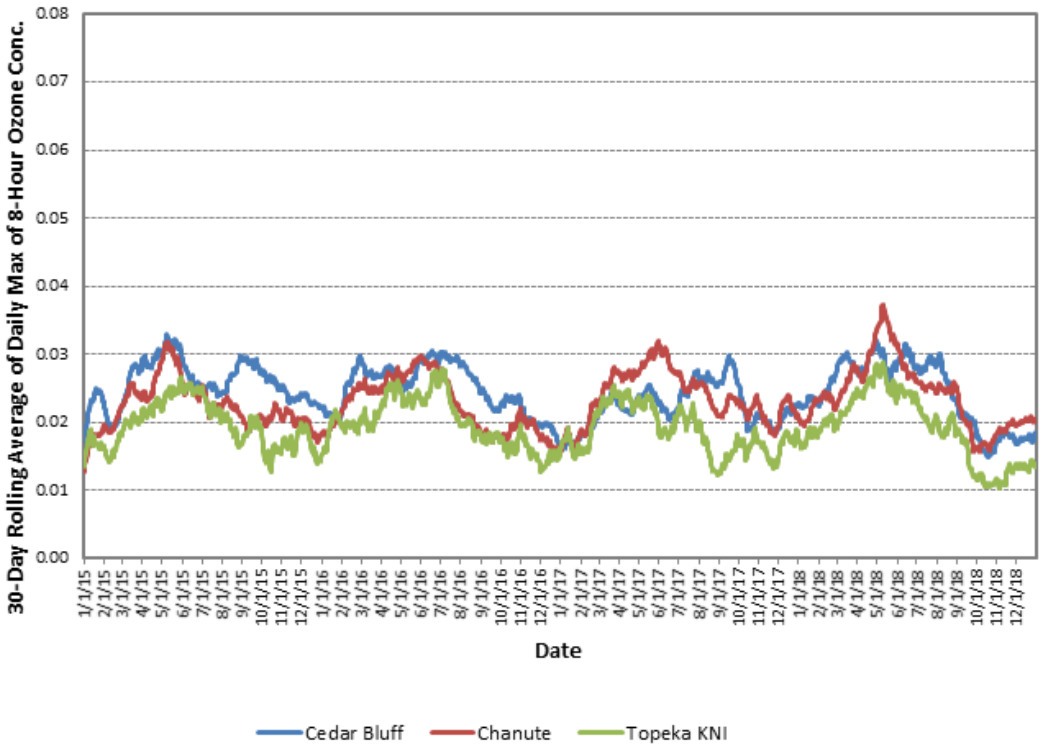
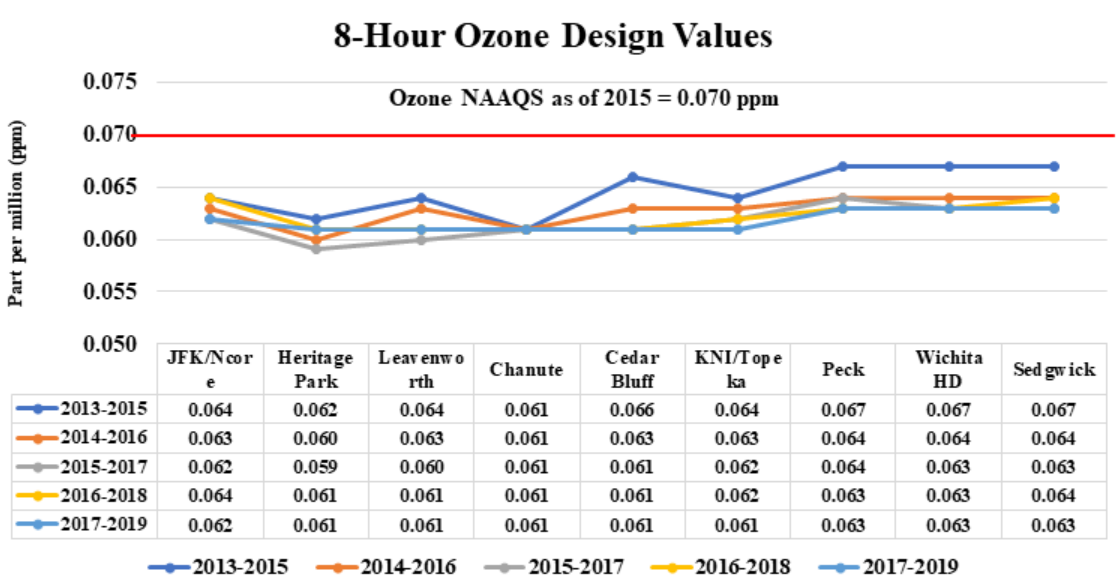


Figure 8. 30-day Rolling Average of Daily Max. 8-hr. Ozone Concentrations at Topeka/KNI, Cedar Bluff, and Chanute 2015–2018

The design values for each O_3 monitor during the last 5 years are listed in Figure 9. Currently no sites have a design value above the health-based standard for ozone. The design value calculated for 2020 includes the data years 2017, 2018, and 2019. All sites in the Kansas Air Monitoring Network have lower or unchanged design values compared with previous years' design values. The downward trend could be a function of meteorological conditions, a reduction in precursor emissions that mix to form ozone, or both.



	JFK/Ncore	Heritage Park	Leavenworth	Chanute	Cedar Bluff	KNI/Topeka	Peck	Wichita HD	Sedgwick
2013-2015	0.064	0.062	0.064	0.061	0.066	0.064	0.067	0.067	0.067
2014-2016	0.063	0.060	0.063	0.061	0.063	0.063	0.064	0.064	0.064
2015-2017	0.062	0.059	0.060	0.061	0.061	0.062	0.064	0.063	0.063
2016-2018	0.064	0.061	0.061	0.061	0.061	0.062	0.063	0.063	0.064
2017-2019	0.062	0.061	0.061	0.061	0.061	0.061	0.063	0.063	0.063

Figure 9. Ozone Design Values for all Kansas Monitors During the Past 5 Years

Correlations between Kansas Ozone Monitors

Figure 10 represents the correlation matrix for ozone produced from the Ambient Air Monitoring Network Assessment Tool, NetAssess2020 v1.1, for January 1, 2016 through December 31, 2018. The tool generates a graphical display that summarizes the correlation, relative difference, and distance between pairs of monitoring sites. The correlation between two sites quantitatively describes the degree of relatedness between the measurements made at two sites. The degree of relatedness between two sites is described by the Pearson correlation, or R-value. Values closer to 1.0 are strongly correlated. Causes for relatedness include but are not limited to distance between sites, sources affecting both sites, and pollutant transport. The correlation may indicate whether a pair of sites are related, but it does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other.

The graphic is divided into two triangles, blue and red, separated by the site design values for ozone in white boxes. The values in the lower triangle (blue) represent the number of observations used in the correlation. The values in the upper triangle (red) represent the number of kilometers between sites. The varying shades of red boxes (upper) represent the mean absolute difference between sites measured in parts per million (ppm). In general, the lighter the shade of red in corresponding boxes the closer the sites are to each other. For example, 20-191-0002 is the AQS ID for Peck in northern Sumner County, and 20-173-0010, located at the Wichita Health Department, is 25 km (15.5 miles) north of Peck. The corresponding mean absolute difference is between 0.001 and 0.002 ppm. Likewise, in the lower triangle these two sites have a strong R-value, meaning that there is an indication that these two sites are measuring similar pollutant concentrations. An alternate example is a comparison between 20-195-0001, Cedar Bluff in Trego County, and 20-209-0021, JFK/NCore in Wyandotte County. The two sites are 444 km (275.9 miles) apart. These two sites have a larger mean absolute difference of between 0.007 and 0.008 ppm.

However, Cedar Bluff and JFK/NCore have a strong data correlation (R-value = 0.7), suggesting that the two sites are measuring similar pollutant concentrations.

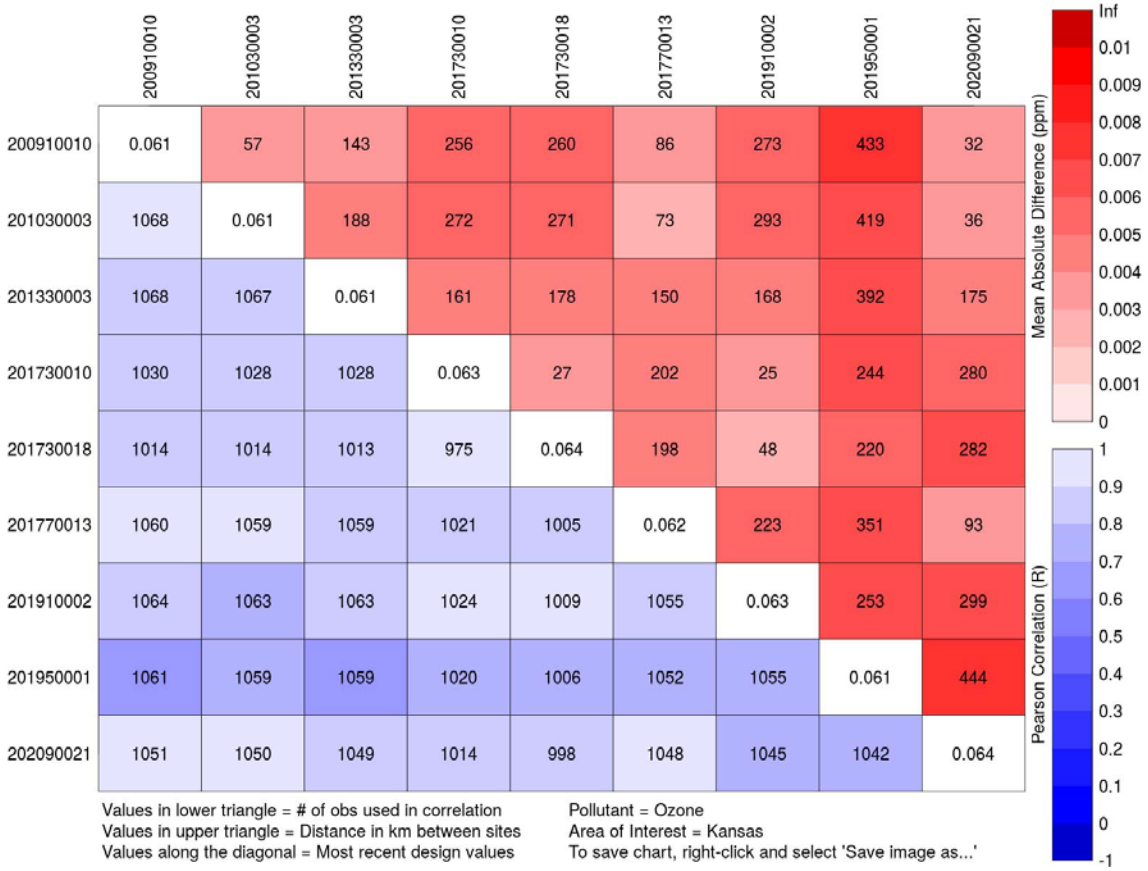


Figure 10. Correlation Matrix for 2016–2018 Ozone Measurements in Kansas

Ozone Removal Bias Analysis

Removal bias is another tool from NetAssess2020 v1.1. It is used to assess site redundancy. The tool finds the nearest neighbors to each selected site and then uses the data from the neighboring sites to estimate concentrations at the site. It then compares the estimates to the actual concentrations measured at the selected site to determine the removal bias. Figure 11 contains all sites measuring ozone and the calculated removal bias for each site. Red indicates positive removal bias; for example, if the site was removed the concentration at said site would be overestimated. Blue indicates negative removal bias; for example, if the site was removed the concentration at said site would be underestimated. The darker the circle color the higher the magnitude of the removal bias. The darkest red circle represents the removal bias at the Cedar Bluff State Park site. This site is designated as the regional background station in Kansas. The darkest blue circle represents the Sedgwick site located approximately 25 miles north of the City of Wichita.

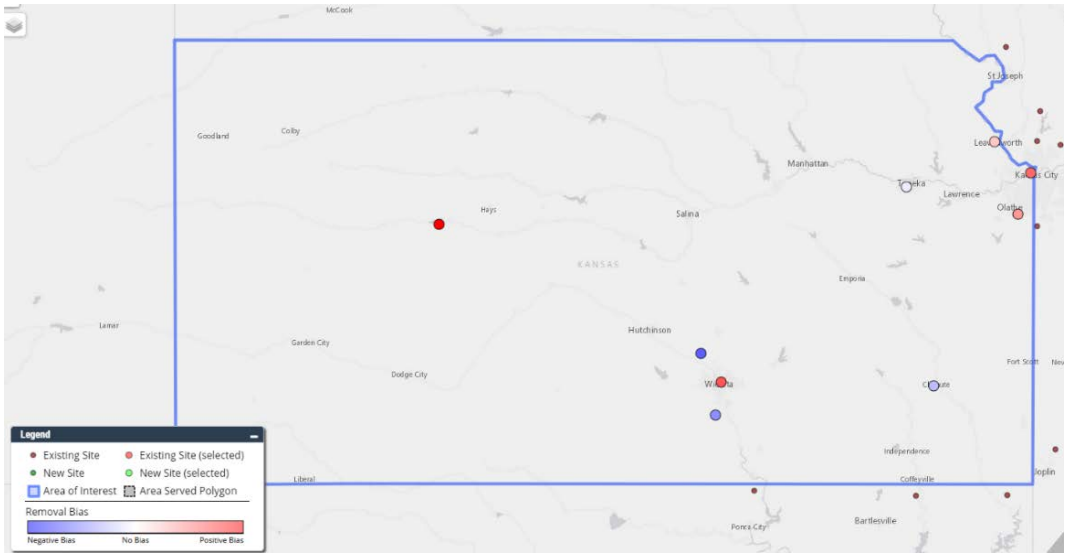


Figure 11. Ozone Monitoring Removal Bias Analysis Map

Proposed Kansas Ozone Monitoring Network 2020-2025

Based on the assessments and available resources there are no immediate plans for site removal, relocation, or addition. The proposed Kansas O_3 monitoring network for the upcoming 5 years is presented in Figure 12. KDHE proposes to maintain the current network configuration in support of established data collection objectives. KDHE will adjust the network by moving, adding, and or removing sites if required. Design values at all sites approach or are equal to the site measuring regional background levels (Cedar Bluff). This may indicate that emissions leading to the ozone formation are lower than in previous years or that meteorological conditions are less favorable to ozone formation during elevated pollutant episodes.

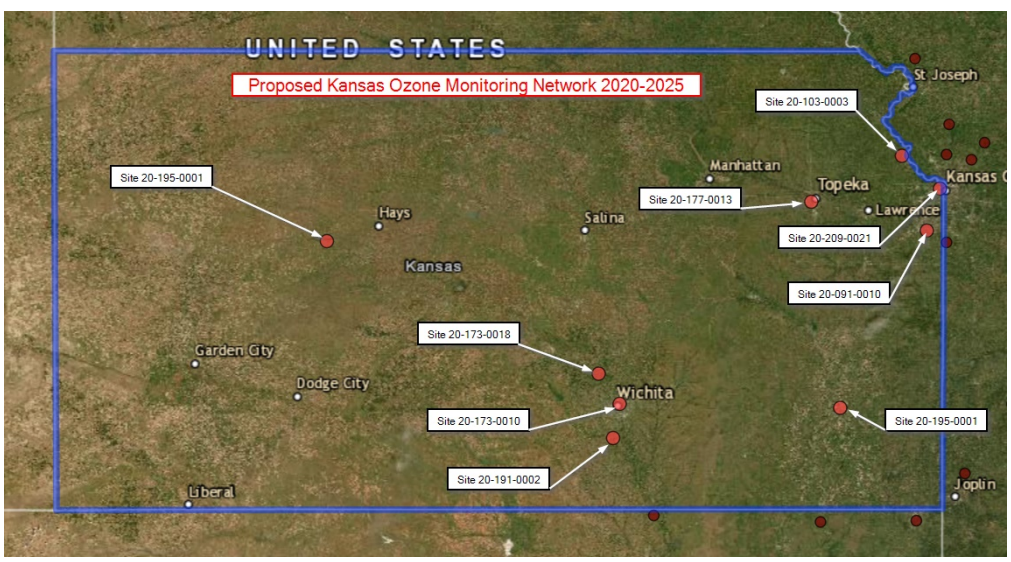


Figure 12. Proposed Kansas Ozone Monitoring Network 2020–2025

$PM_{2.5}$ Monitoring Network

Current $PM_{2.5}$ Standard and Monitoring Requirements

Current national ambient air quality standards (NAAQS) for $PM_{2.5}$ have been set to 12 micrograms per meter cubed (µg/m^3) annual average for the primary, and 15 µg/m^3 annual average for the secondary, and 35 µg/m^3 24-hour average for both the primary standard and the secondary standard (http://www.gpo.gov/fdsys/pkg/FR-2013-01-15/pdf/2012-30946.pdf). The annual standard is based on a 3-year average of the annual mean. The 24-hour standard is based on a 3-year 98th percentile average of 24-hour values. Current minimum monitoring requirements for $PM_{2.5}$ are shown in Table 2.

Table 2. $PM_{2.5}$ Minimum Monitoring Requirements (Number of Stations per MSA)

Population Category	3-yr design value ≥ 85% of NAAQS	3-yr design value < 85% of NAAQS
> 1,000,000	3	2
500,000 - 1,000,000	2	1
50,000 - 500,000	1	0

In addition to the minimum number of monitors required, there are also requirements for a minimum number of continuous monitors to be deployed. Fifty percent of the minimum required numbers of monitoring sites are required to be a continuous $PM_{2.5}$ monitor. For Kansas this means that at a minimum two continuous $PM_{2.5}$ monitors need to be operated in the state.

Applying EPA's minimum monitoring requirements to Kansas urban areas, population totals, and historical $PM_{2.5}$ measurements, the network's design requirements are shown in Table 3. According to Tables 2 and 3, $PM_{2.5}$ monitors could be removed from the Wichita area and the Kansas City area, assuming the Missouri side of Kansas City retains (a) $PM_{2.5}$ monitor(s).

Table 3. Minimum Number of $PM_{2.5}$ Monitors Required in Kansas MSAs

Metropolitan area	Population (2018 est.)	Max. 2019 annual design value as % of standard (12 µg/m^3)	Max. 2019 daily design value as % of standard (35 µg/m^3)	2020 sites with FRM or FEM monitor	Minimum requirement
Kansas City, MO-KS	2,143,651	78	69	2 (KS side only)	2
Lawrence, KS	121,436	Not monitored		0	0
Manhattan, KS	97,980	Not monitored		0	0
NCore (KC, KS JFK)		Not a population-based requirement		1	1
St. Joseph, MO-KS	126,490	72	51	1 (MO)	0
Topeka, KS	232,594	75	63	1	0
Wichita, KS	644,888	53	46	2	1
Near-road phase 1 (KC, MO)		Not a population-based requirement		1 (MO)	1

State of Kansas Current $PM_{2.5}$ Monitoring Network

The 2020 Kansas $PM_{2.5}$ monitoring network includes nine monitors at seven different monitoring sites located throughout the state. Two are continuous Tapered Element Oscillating Microbalance (TEOM), one is a T640, and four are T640x. Monitor locations and type are listed in Table 4 along with detailed site information. Two sites have collocated filterable $PM_{2.5}$ measurements (2025i), one at JFK in Kansas City and one at the Heritage Park site in Olathe. Both of those sites also contain continuous monitors.

Table 4. State of Kansas $PM_{2.5}$ Monitor Sites

Site Name	Site ID	City	Address	Latitude	Longitude	$PM_{2.5}$ (filter)	$CPM_{2.5}$
Cedar Bluff	20-195-0001	Cedar Bluff	Pronghorn & Muley (Cedar Bluff Reservoir)	38.770081	-99.763424	No	Yes
Chanute	20-133-0003	Chanute	1500 W 7th St	37.67696	-95.47594	No	Yes
Health Dept.	20-173-0010	Wichita	1900 E 9th St	37.702066	-97.314847	No	Yes
Heritage Park	20-091-0010	Olathe	13899 W 159th St	38.838575	-94.746424	Yes	Yes
Kansas City JFK/ NCore	20-209-0021	Kansas City	1210 N 10th St	39.117219	-94.635605	Yes	Yes
KNI	20-177-0013	Topeka	2501 Randolph Ave	39.024265	-95.711275	No	Yes
Peck	20-191-0002	Peck	707 E 119th St S	37.47689	-97.366399	No	Yes

Figure 13 shows the population density (2010 Census) of the State of Kansas along with the $PM_{2.5}$ monitoring sites. All these monitors have 3-year design values below 85% of the NAAQS concentration category.

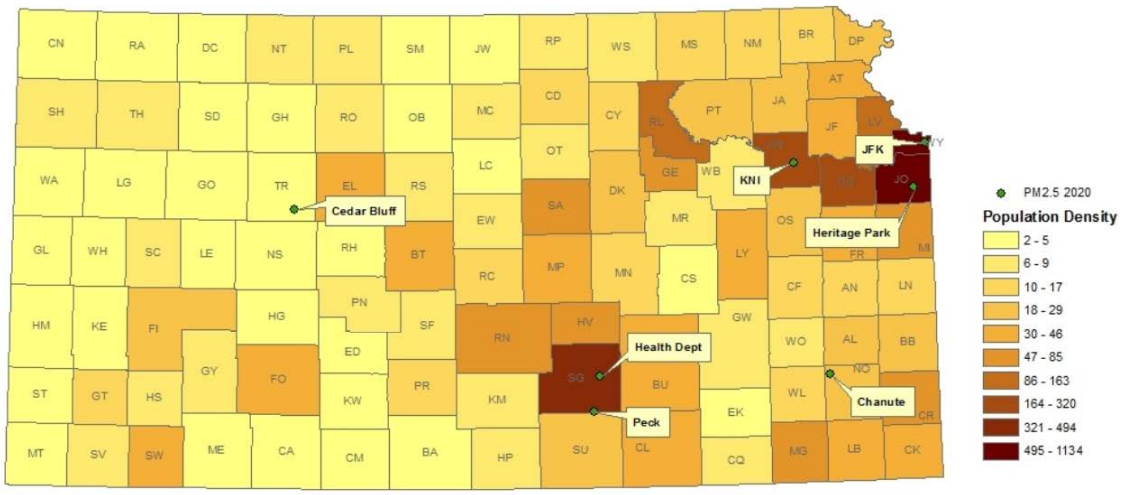


Figure 13. Kansas Population Density Map and $PM_{2.5}$ Monitor Locations

$PM_{2.5}$ Measurements Trend Analysis

All $PM_{2.5}$ measurements were evaluated for trend analysis. Figure 14 displays the $PM_{2.5}$ 98th percentile values for the Kansas monitors between 2005 and 2019. As can be seen from the graphic, the values vary on a year to year basis, but the overall trend is downward on all monitors across the network.

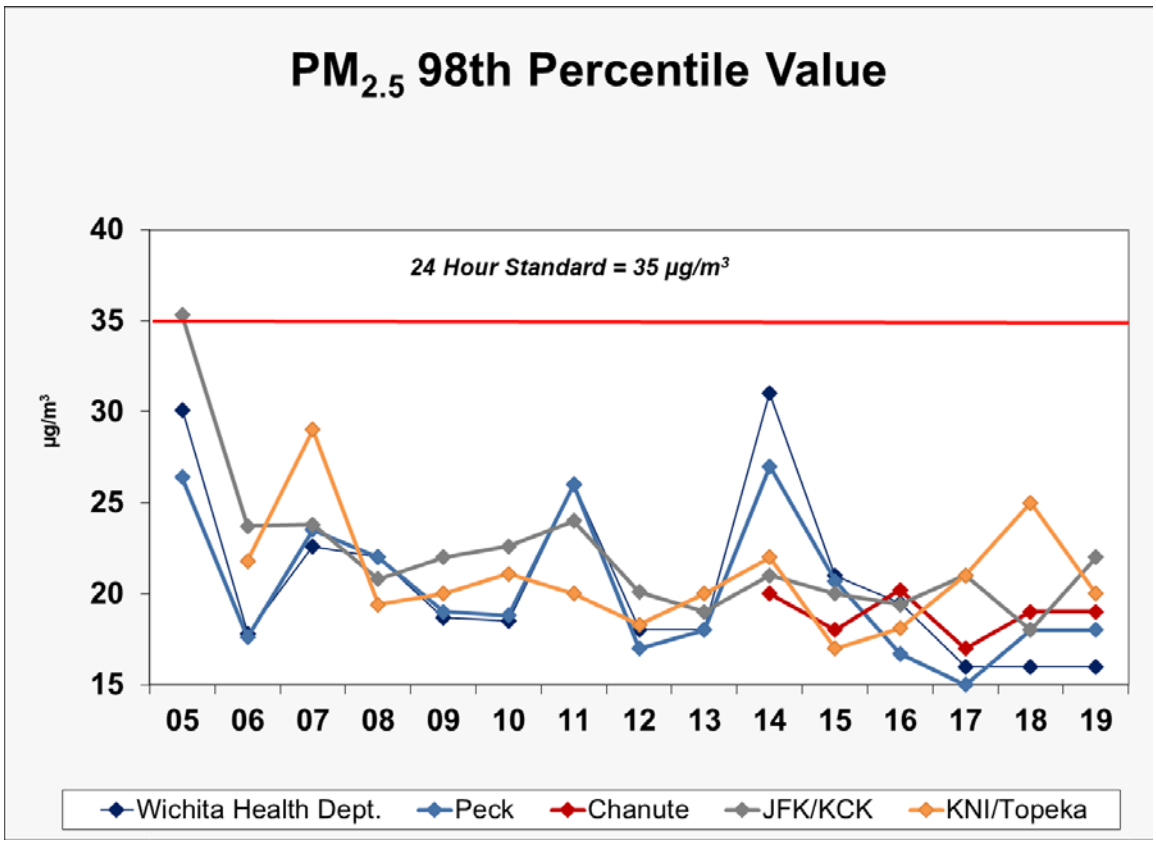


Figure 14. Kansas $PM_{2.5}$ 98th Percentile Value

The JFK/KCK monitor has decreased from a value of 35 µg/m^3 in 2005 to 22 µg/m^3 in 2019—a drop of 13 µg/m^3 over that 15-year period. Similarly, the monitor located in Wichita (Wichita Health Department) went from 30 µg/m^3 in 2005 to 16 µg/m^3 in 2019. This is a significant drop of 14 µg/m^3. Although not as significant, the other Kansas $PM_{2.5}$ monitors have decreased over this time frame as well. In fact, all monitors remain comfortably under the 24-hr standard of 35 µg/m^3. Very similar trends are seen when looking at the annual averages. Figure 15 provides the $PM_{2.5}$ annual means data from 2002 to 2019. As is seen in the 98th percentile case the trend, although variable on a year-to-year basis, shows all monitors on a downward trend line.

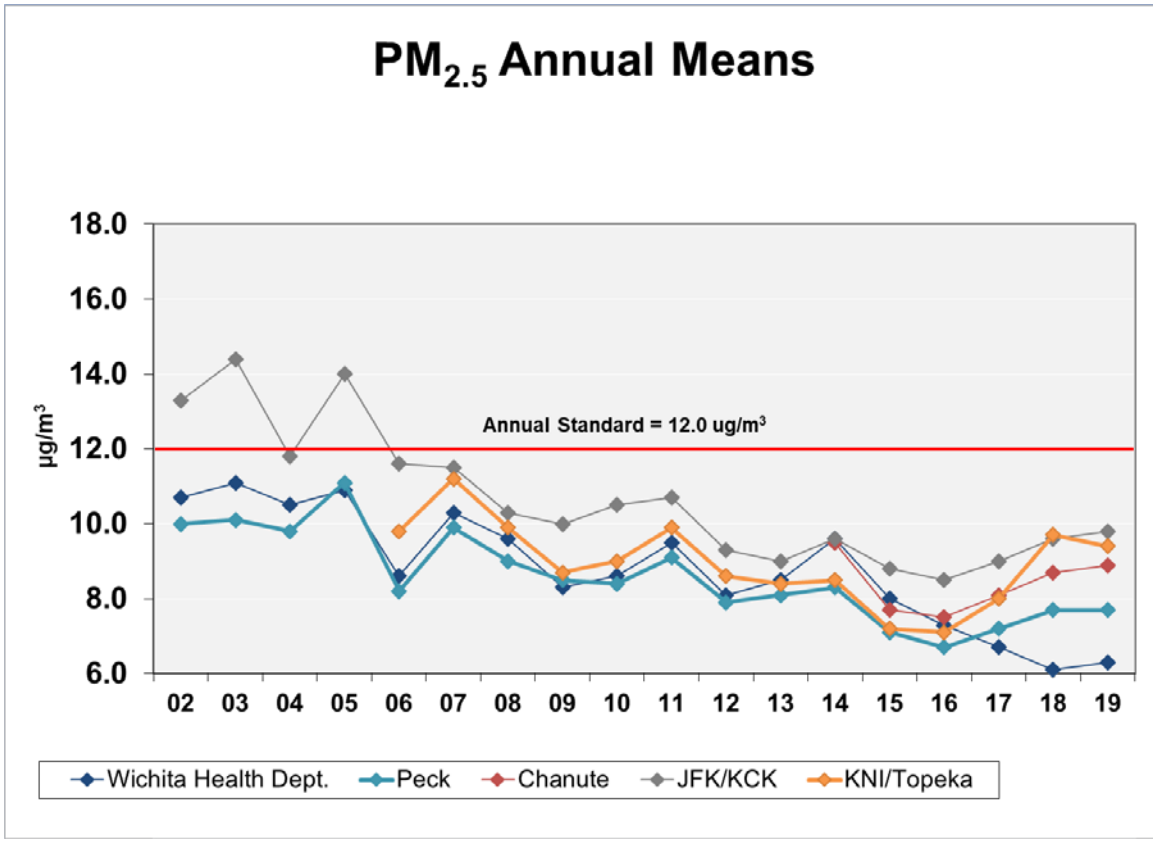


Figure 15. $PM_{2.5}$ Annual Means 2002–2019

The design values for each $PM_{2.5}$ monitor have been listed in Tables 5 and 6. There are no values exceeding the current NAAQS for $PM_{2.5}$ annual or 24-hour standards. All federal reference monitors are also below 85% NAAQS threshold used for determining minimum monitoring requirements.

Table 5. $PM_{2.5}$ 24-hr Design Values - Kansas Monitors (µg/m³)

Site name	2017–2019 average
Cedar Bluff (TEOM,1405-DF now a T640X)	*14*
Chanute	18
Heritage Park	17
Kansas City JFK/NCore (TEOM-FDMS,1405-DF now a T640X)	*20*
Peck	17
Topeka KNI	22
Wichita Health Dept.	16

Table 6. $PM_{2.5}$ Annual Means Design Values - Kansas Monitors (µg/m^3)

Site name	2017–2019 average
Cedar Bluff (TEOM,1405-DF, now T640x)	*5*
Chanute	8.6
Heritage Park	6.4
Kansas City JFK/NCore (TEOM-FDMS,1405-DF now a T640X)	*9.5*
Peck	7.5
Topeka KNI	9
Wichita Health Dept.	6.4

Correlations Between Kansas $PM_{2.5}$ Monitors

Figure 16 presents the correlation matrix produced from the NetAssess2020 analysis tool[1] (https://sti-r-shiny.shinyapps.io/EPA_Network_Assessment/) for January 1, 2016 through December 31, 2018 $PM_{2.5}$ measurements. This correlation matrix tool generates a graphical display that summarizes the correlation, relative difference, and distance between pairs of monitoring sites. Each monitor comparison is represented by a square in the chart. The blue squares in the bottom-left corner show the correlation between each pair of monitors, with text indicating the number of days used in the calculation. The red squares in the top-right corner show the mean absolute difference in concentrations between each pair of monitors, with text indicating the distance in kilometers between each pair of monitors. The numbers along the diagonal indicate the most recent design value for each monitor (2016–2018). The correlation between two sites quantitatively describes the degree of relatedness between the measurements made at two sites. That relatedness could be caused by various influences, including a common source affecting both sites to pollutant transport caused by meteorology. The degree of relatedness between two sites is described by the R-value. Values closer to 1.0 are strongly correlated. Causes for relatedness include but are not limited to distance between sites, sources affecting both sites, and pollutant transport. The correlation may indicate whether a pair of sites are related, but it does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other.

[1] The NetAssess2020 app was developed by EPA's Office of Air Quality Planning and Standards (OAQPS). It is an update of the NetAssess application developed by LADCO for the 2015 5-year Ambient Air Monitoring Network Assessments.

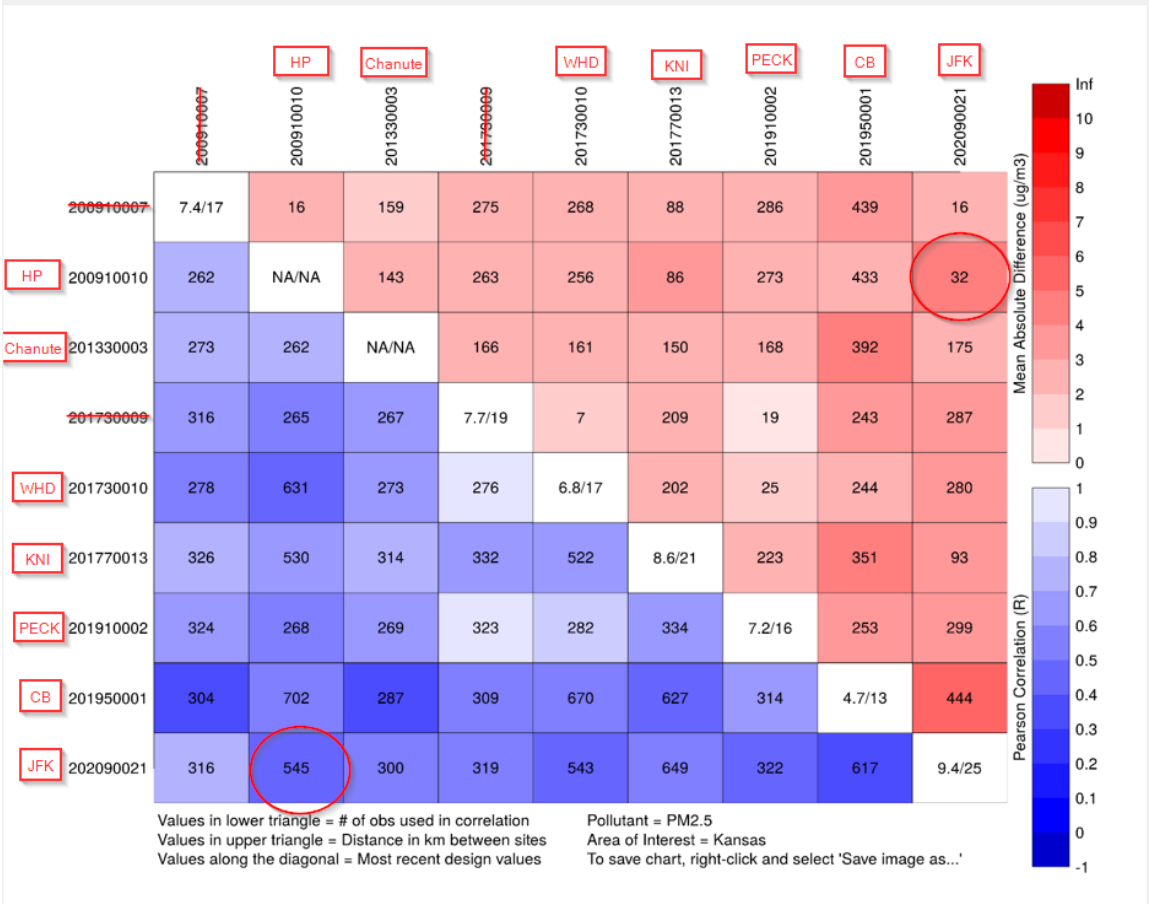


Figure 16. Correlation Matrix for 2016–2018 $PM_{2.5}$ Measurements in Kansas

Two sites listed on the NetAssess2020 program have been removed from the KDHE network. Those two sites were 20-173-0009 (Pawnee and Glenn, in Wichita) and 20-091-0007 (Justice Center, in Kansas City). Interesting correlations were observed for the two Kansas City monitoring sites. As can be seen on the correlation between JFK and HP (Heritage Park), the darker blue color shows there exists little correlation, with a $0.4R^2$ or $0.5R^2$. In fact, JFK correlates better with Chanute and KNI (Topeka) than with HP. Similarly with the mean absolute difference, a darker color exists between JFK and HP than between JFK and all other sites except for CB (Cedar Bluff). This data would indicate JFK and Heritage Park are two significantly different sites within 32 km of each other.

On the other hand, the two Wichita area sites (WHD and Peck) show very high (> 0.8 R^2) correlation between each other, as well as low mean absolute difference values. The two sites are located within 25 kilometers of each other. Based on the correlation and the relatively close distance between the two sites, it seems feasible that one of the Wichita $PM_{2.5}$ sites could be removed, but because Peck is a transport site, KDHE does not plan at this time to remove the site.

Topeka KNI is an urban site not very far away (~80 km west) from the Kansas City urban center sites; this site does not show a significant correlation with the two Kansas City sites.

The remaining sites are also farther distances from the urban core, and generally are not correlated because of the large distances between locations. Even though the correlations are low, most of these sites have similar low design values—all below the NAAQS for both the annual and 24-hour standard.

$PM_{2.5}$ Removal Bias Analysis

The NetAssess removal bias tool is meant to aid in determining redundant sites. The bias estimation uses the nearest neighbors to each site to estimate the concentration at the location of the site if the site had never existed. This is done using the Voronoi Neighborhood Averaging algorithm with inverse distance squared weighting. The squared distance allows for higher weighting on concentrations at sites located closer to the site being examined. The bias was calculated for each day at each site by taking the difference between the predicted value from the interpolation and the measured concentration. A positive average bias would mean that if the site being examined was removed, the neighboring sites would indicate that the estimated concentration would be larger than the measured concentration. Likewise, a negative average bias would suggest that the estimated concentration at the location of the site is smaller than the actual measured concentration. Figure 14 shows the results of this removal bias tool run for $PM_{2.5}$ sites in Kansas. Red circles indicate positive bias while blue indicate negative bias. If the bias is small, that may indicate that the monitor is redundant and could be removed.

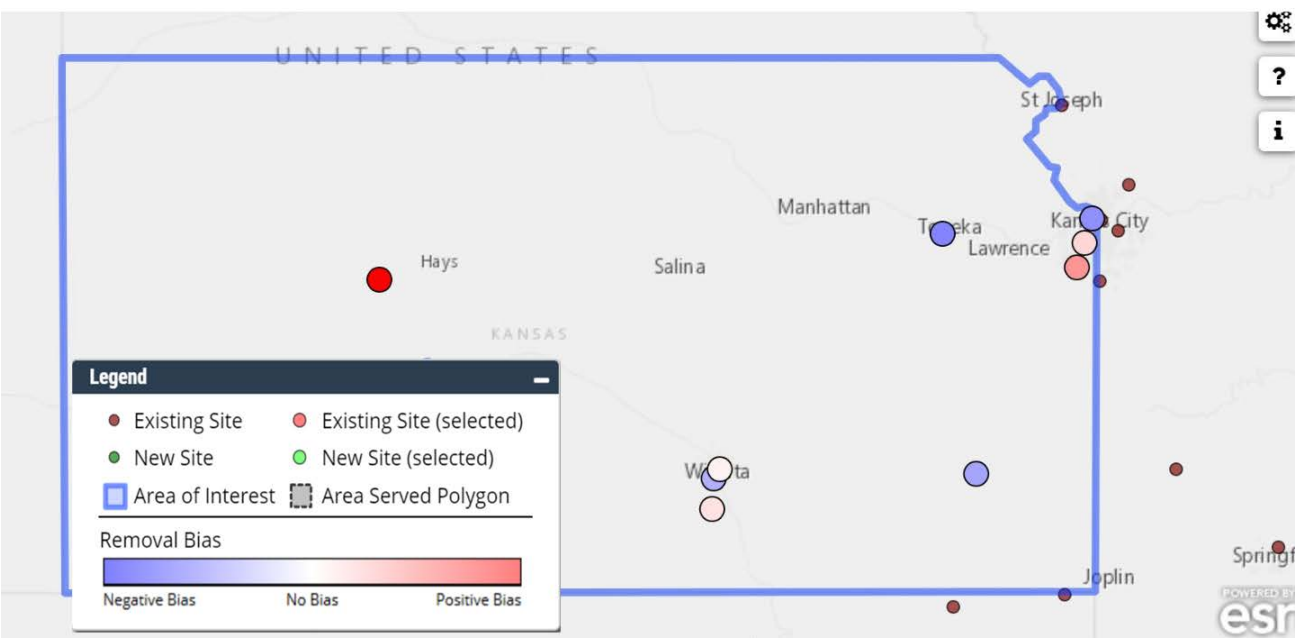


Figure 17. $PM_{2.5}$ Removal Bias Map

Proposed Kansas $PM_{2.5}$ Monitoring Network 2020–2025

After a careful review of all the above factors, the proposed Kansas $PM_{2.5}$ monitoring network for the upcoming five years is presented in Figure 18. This proposal reflects the population-based monitoring requirements along with the current $PM_{2.5}$ monitored values.

Overall, KDHE proposes to install continuous T640x $PM_{2.5}$ monitors at Heritage Park and Wichita Health Dept. to replace the current continuous TEOMs. In addition, the Topeka KNI T640 continuous monitor will be upgraded to the T640x model. This will complete the switch of our current continuous monitors to all T640x models.

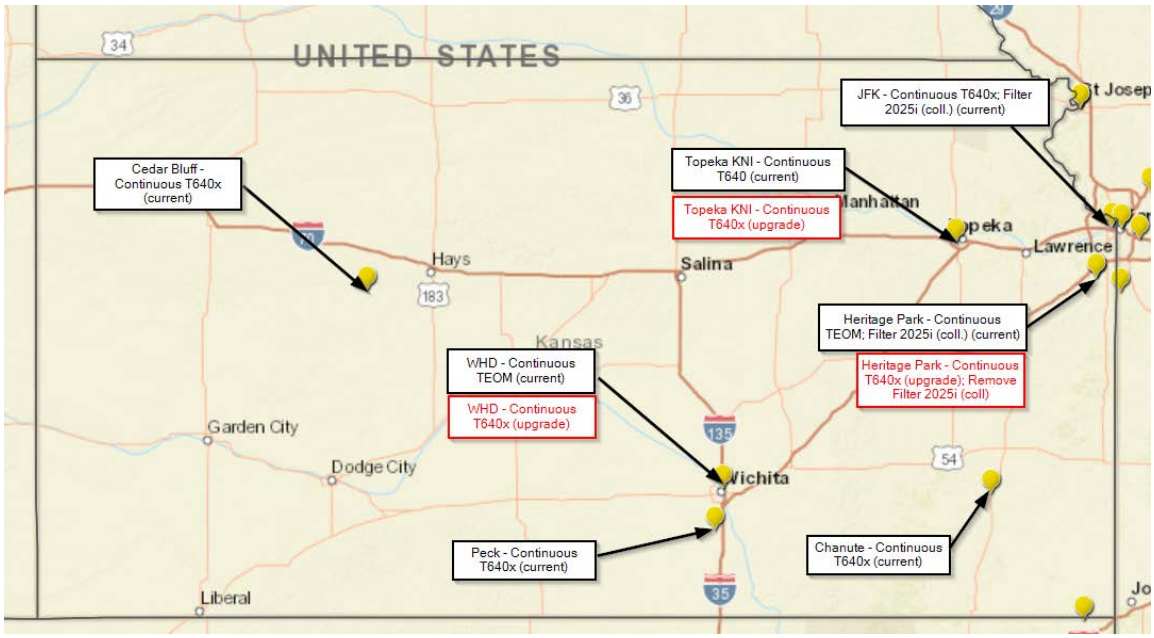


Figure 18. Proposed $PM_{2.5}$ Monitoring Network 2020–2025

PM_{10} Monitoring Network

Current PM_{10} Standard and Monitoring Requirements

Current national ambient air quality standards (NAAQS) for PM_{10} has been set to 150 micrograms per meter cubed for both the primary standard and the secondary standard (http://www.epa.gov/ttn/naaqs/standards/pm/data/fr20061017.pdf). This standard is not to be exceeded more than once per year on average over 3 years. Current minimum monitoring requirements for PM_{10} are shown in Table 7.

Table 7. Minimum Monitoring Requirements (Number of Stations per MSA)[1]

Population Category	High concentration[2] (µg/m³)	Medium concentration[3] (µg/m³)	Low concentration[4,5] (µg/m³)
> 1,000,000	6–10	4–8	2–4
500,000 - 1,000,000	4–8	2–4	1–2
250,000 - 500,000	3–4	1–2	0–1
100,000 - 250,000	1 -2	0–1	0

[1] Selection of urban areas and actual numbers of stations per area within the ranges shown in this table will be jointly determined by EPA and the State Agency.
[2] High concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding the PM_{10} NAAQS by 20% or more.
[3] Medium concentration areas are those for which ambient PM_{10} data show ambient concentrations exceeding 80% of the PM_{10} NAAQS.
[4] Low concentration areas are those for which ambient PM_{10} data show ambient concentrations < 80% of the PM10 NAAQS.
[5] These minimum monitoring requirements apply in the absence of a design value.

Applying the minimum monitoring requirements to Kansas urban areas, population totals and historical PM_{10} measurements results in the design requirements are shown in Table 8. According to Tables 7 and 8, a PM_{10} monitor could be removed from the Wichita area.

Table 8. Minimum Number of PM_{10} Monitors Required in Kansas MSAs

MSA	Population (2018 est.)	Number of existing PM_{10} monitors	PM_{10} monitors required
Kansas City, MO-KS	2,143,651	1 (KS side only currently but 2 expected in near term)	2–4
Lawrence, KS	121,436	0	0
Manhattan, KS	97,980	0	0
St. Joseph, MO-KS	126,490	0	0
Topeka, KS	232,594	1	0–1
Wichita, KS	644,888	2	1–2

State of Kansas Current PM_{10} Monitoring Network

The current Kansas PM_{10} monitoring network includes eight monitors located throughout the state at eight monitoring sites. All eight monitors are continuous models. Monitor locations and type are listed in Table 9 along with detailed site information.

Table 9. State of Kansas PM_{10} Monitor Sites

Site Name	Site ID	City	Address	Latitude	Longitude	Cont. PM_{10}
Cedar Bluff	20-195-0001	Trego County	Pronghorn & Muley (Cedar Bluff Reservoir)	38.770081	-99.763424	Yes
Chanute	20-133-0002	Chanute	1500 W 7th St	37.676960	-95.475940	Yes
Dodge City	20-057-0002	Dodge City	Dodge City Community College	37.773410	-100.035434	Yes
Goodland	20-181-0003	Goodland	713 E 16th St	39.342808	-101.702882	Yes
Health Dept.	20-173-0010	Wichita	1900 E 9th St	37.702066	-97.314847	Yes
Kansas City JFK/NCore	20-209-0021	Kansas City	1210 N. 10th St (JFK Rec. Center)	39.117219	-94.635605	Yes
KNI	20-177-0013	Topeka	2501 Randolph Ave	39.024265	-95.711275	Yes
Peck	20-191-0002	Peck	707 E 119th St S	37.476890	-97.366399	Yes

Figure 19 shows the population density of the state of Kansas along with the PM_{10} monitoring sites. All these monitors have 3-year design values in the Low (< 80% of the NAAQS) concentration category.

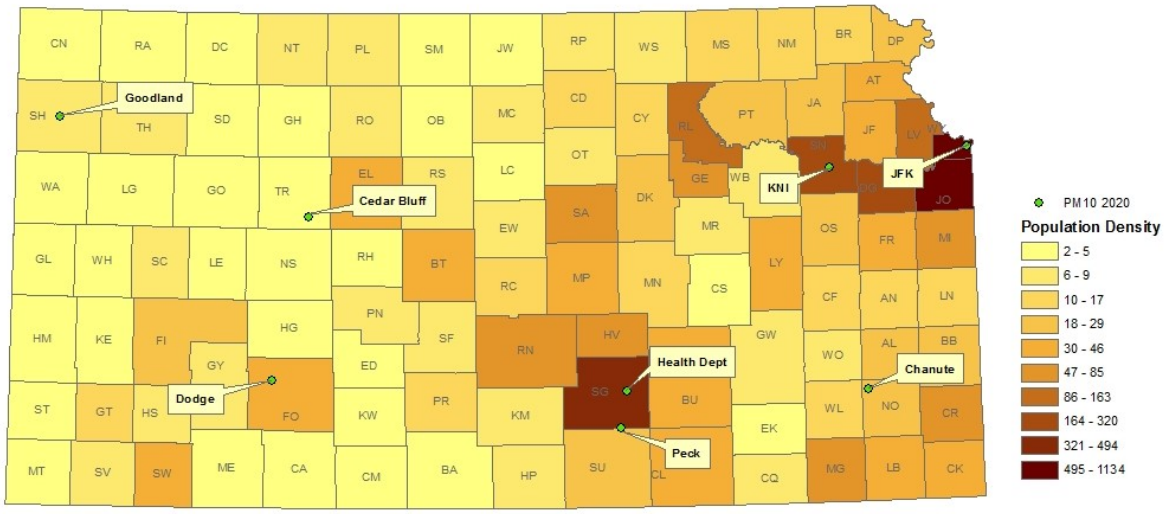


Figure 19. Kansas Population Density Map and PM_{10} Monitor Locations

PM_{10} Measurements Trend Analysis

Both the continuous and filter-based PM_{10} measurements were evaluated for trends. The trend over the 18-year period 2002–2019 has been upward for the western and south-central sites. Only the far eastern sites have shown a slight downward trend in values. Figure 20 shows the 24-hour maximum yearly value of the eight sites over this timeframe. Note in Figure 20 that the Peck site is not represented. (Peck does not have three years of data and thus no design value.) Also, the two sites labeled Wichita GP and Wichita K96 have been removed from the network.

Overall, the average readings across the state are below the NAAQS standard, with occasional values above the standard caused by dry conditions (drought) leading to dust storms in western Kansas. The two days of exceedances (Oct. 2012 & April 2014) were caused by dust storms and exceptional event requests letters were submitted to EPA Region 7. In addition, two exceedances occurred in 2017 and 2018 and were also the result of large regional dust storms.

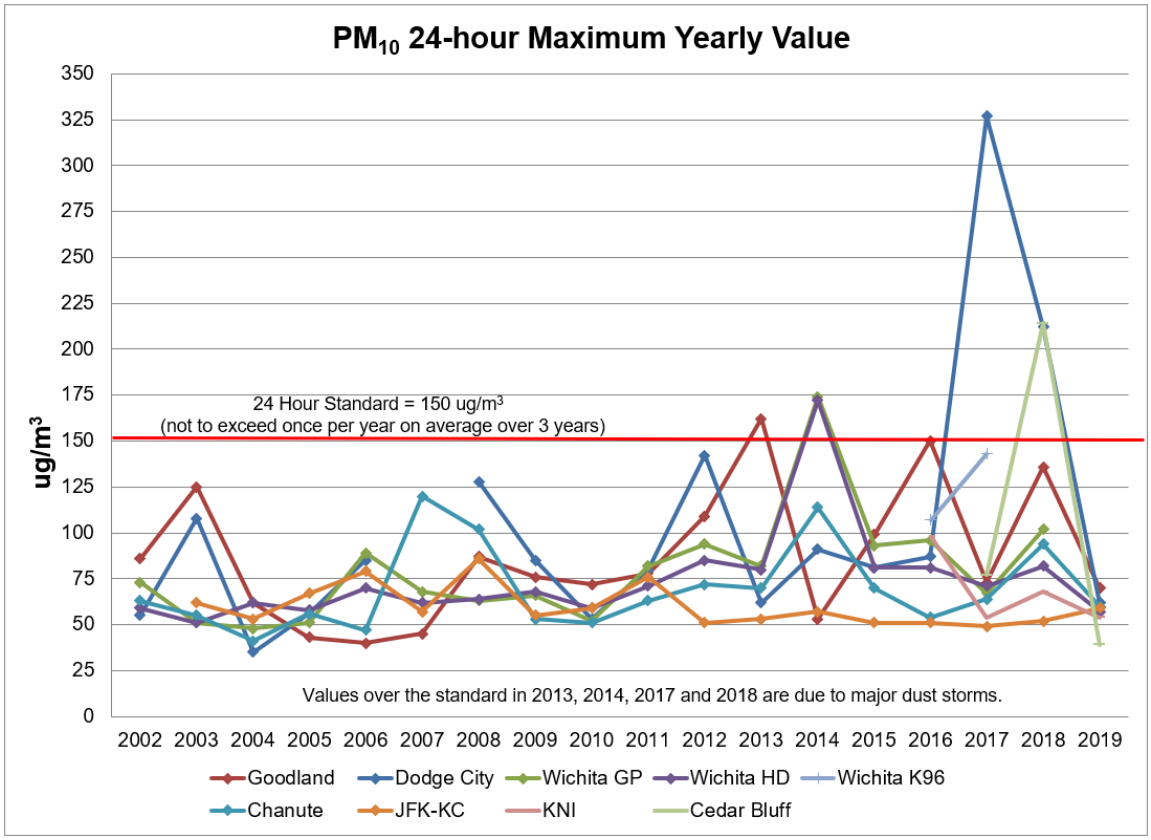


Figure 20. PM_{10} 24-hr Maximum Yearly Value Monitoring Data Trend 2002–2019

Figure 21 shows the PM_{10} monitoring data for PM_{10} sites in the state (except Peck) compared in a different format in order to better see the side by side comparisons for each site by year. Note again the higher readings that occurred in 2013, 2014, 2017, and 2018. The exceedance in 2013 was located at the Goodland monitor and the 2014 exceedances occurred at monitors in the Wichita metropolitan area, and both were caused by dust storms associated with strong low-pressure systems. Both days were flagged, and exceptional event requests were sent to EPA Region 7. EPA concurred on the Goodland 2013 event. In addition, the exceedance in 2017 occurred at the Dodge City monitor and at both the Dodge City and Cedar Bluff monitor sites, and again were caused by regional dust storm events. The important point is both the continuous and filter-based monitors have been below the standard except for years with massive dust storms. The Glenn and Pawnee (Wichita GP) and K-96 (Wichita K96) monitors in Wichita have now been removed from the network.

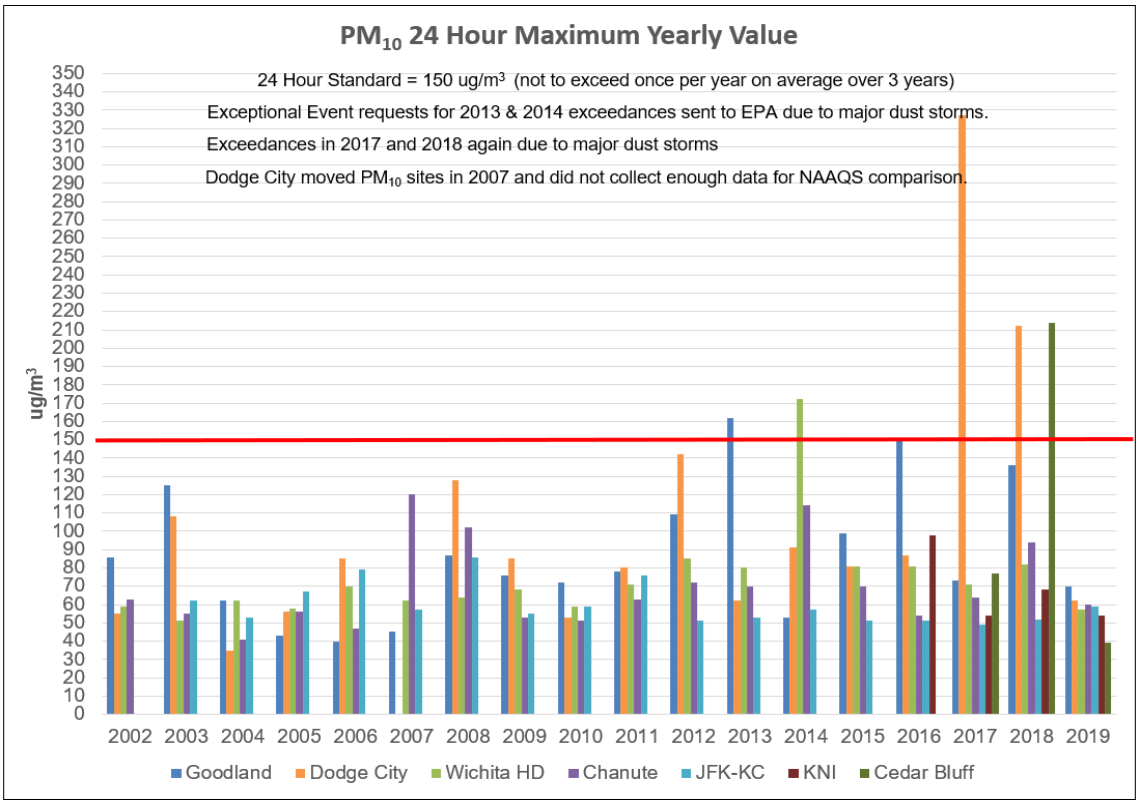


Figure 21. PM_{10} 24-hr Maximum Yearly Values 2002–2019

The design values for each of the current PM_{10} monitors have been listed in Table 10. There are no values exceeding the current NAAQS. The Dodge City monitor has the highest design value reading of 118 µg/m^3 but is below the 150 µg/m^3 standard. This monitor has been affected by several dust storms during this period, which has increased its design value significantly. One monitor, Peck, does not have three years of data and thus no design value is provided for this monitor.

Table 10. PM_{10} Design Values for all Kansas Monitors (µg/m^3)

Site Name	2017 2nd high	2018 2nd high	2019 2nd high	2017–2019 design value
Cedar Bluff (T640x)	66	42	37	48
Chanute (T640x)	57	55	56	56
Dodge City (TEOM)	155	140	60	118
Goodland (TEOM)	23	64	80	56
JFK (T640x)	46	46	52	48
KNI (TEOM) (T640x upgrade Fall 2020)	49	61	52	54
Peck (T640x)	*	56	64	**
Wichita Health Dept. (TEOM) (T640x upgrade)	57	51	129	79

*No data
**3 years of data not available for calculation

Proposed Kansas PM_{10} Monitoring Network 2020–2025

After a careful review of all the above factors, the proposed Kansas PM_{10} monitoring network for the upcoming five years is presented in Figure 22. This proposal reflects the population-based monitoring requirements along with the current PM_{10} monitored values. Overall, KDHE proposes to augment its network by replacing the Wichita Health Department's TEOM with a T640X monitor. Although KDHE mentioned in the last network assessment report that it was going to replace the Goodland filter-based monitor with a continuous monitor located at the Cedar Bluff monitoring site, KDHE left the Goodland monitor in place and replaced it with a continuous monitor. KDHE also installed a continuous monitor at the Cedar Bluff site in Trego County and installed a new T640x monitor at the Heritage Park site in the Kansas City metropolitan area that will allow PM_{10} monitoring. This will leave nine continuous PM_{10} monitors, one in Goodland, Cedar Bluff (Trego Co.), Dodge City, Peck (Sumner Co.), Wichita Health Department, Chanute, Topeka, Heritage Park (Johnson Co.), and one in Kansas City, KS.

Figure 22. Proposed PM_{10} Monitoring Network 2020–2025

NCore Monitoring Site

National Ambient Air Monitoring Strategy

NCore is a multi-pollutant network that integrates several advanced measurement systems for particles, pollutant gases, and meteorology. Most NCore stations have been operating since the formal start of the network on January 1, 2011.

Monitoring Objectives

The NCore Network addresses the following objectives:

- Timely reporting of data to public by supporting AIRNow, air quality forecasting, and other public reporting mechanisms;
- Support for development of emission strategies through air quality model evaluation and other observational methods;
- Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors;
- Support for long-term health assessments that contribute to ongoing reviews of the NAAQS;
- Compliance through establishing nonattainment/attainment areas through comparison with the NAAQS;
- Support to scientific studies ranging across technological, health, and atmospheric process disciplines; and
- Support to ecosystem assessments recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed to address ecosystem analyses.

At a minimum, NCore monitoring sites must measure the parameters shown in Table 11.

Table 11. NCore Monitoring Site Measurement Parameters

Parameter	Comments
$PM_{2.5}$ speciation	Organic and elemental carbon, major ions and trace metals (24-hour average; every 3rd day); IMPROVE or CSN
$PM_{2.5}$ FRM mass	24 hr. average at least every 3rd day
continuous $PM_{2.5}$ mass	1-hour reporting interval; FEM or pre-FEM monitors
PM (10-2.5) mass	Filter-based or continuous
Ozone (O_3)	All gases through continuous monitors
Carbon monoxide (CO)	Capable of trace levels (low ppm and below) where needed
Sulfur dioxide (SO_2)	Capable of trace levels (low ppb and below) where needed
Nitrogen oxide (NO)	Capable of trace levels (low ppb and below) where needed
Total reactive nitrogen (NO_y)	Capable of trace levels (low ppb and below) where needed
Surface meteorology	Wind speed and direction (reported as "Resultant"), temperature, RH

NCore and PAMS Site – JFK/NCore

20-209-0021; Kansas City, KS:

This site (Figs. 23 and 24) functions as an urban multi-pollutant monitoring station, measuring the required parameters. The measured site parameters will be significantly expanded due to the federal implementation of Photochemical Assessment Monitoring

Stations (PAMS). The JFK/NCore site, which will include PAMS by summer of 2021, is located close to Nebraska Ave and North 10th Street, Kansas City, Kansas (N 39.117219; W 94.635605).

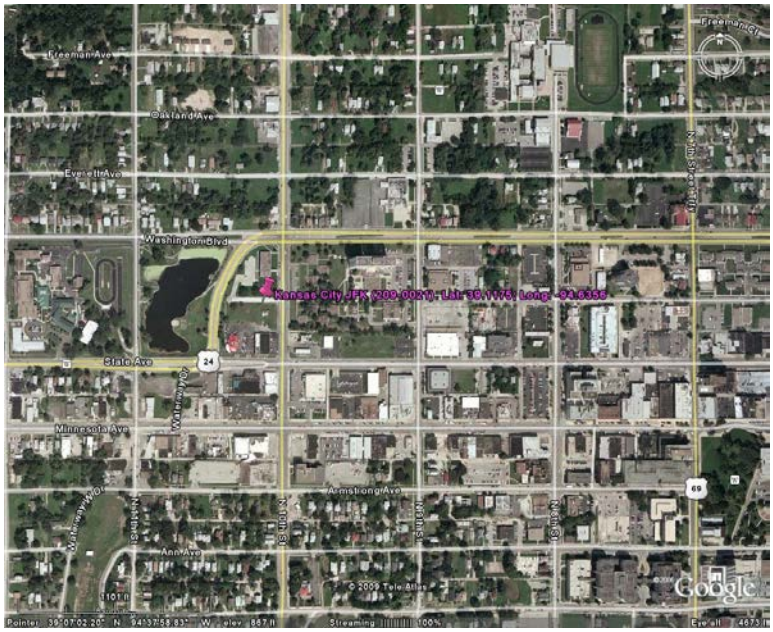


Figure 23. Kansas City, KS JFK NCore Site Map

Figure 24. Kansas City, KS JFK NCore Site

KDHE will maintain the current location for the required NCore parameters. It is anticipated that in fall of 2020 the site will include some of the new equipment for the photochemical assessment of ground-level ozone and the pollutants that form it, and meteorology to better understand ozone formation and to evaluate national and local ozone-

reduction options. PAMS parameters are anticipated to be reported by the 2021 ozone season. A list is included in Appendix F.

Kansas Ambient Air Monitoring Plan for Lead (Pb)

Source-Oriented Monitoring

According to 40 CFR Part 58 Appendix D, paragraph 4.5(a), state and (where appropriate) local agencies are required to conduct ambient air monitoring for lead (Pb), considering Pb sources that are expected to or have been shown to contribute to a maximum Pb concentration in ambient air in excess of the NAAQS. At a minimum, there must be one source-oriented SLAMS site located to measure the maximum Pb concentration in ambient air resulting from each Pb source that emits one-half (0.5) or more tons per year. A search of reported emissions for 2007 revealed that only one source in Kansas exceeds the one-half ton threshold. Currently, one source located in Salina, KS (Exide Technologies) exceeded the one-half ton threshold.

According to 40 CFR Part 58 Appendix D, paragraph 4.5(a), source-oriented monitors are to be sited at the location of predicted maximum concentration in ambient air, considering the potential for population exposure and logistics. Typically, dispersion modeling is required to identify the location of predicted maximum concentration.

Dispersion modeling was performed by KDHE to determine the area of maximum concentration for sampler placement. KDHE prepared a Monitoring Plan for Airborne Lead in 2009.

The lead monitoring site near the Exide Technologies facility at Salina, KS is designated with AQS site ID 020-169-0004. A high volume (HiVol) total suspended particulate (TSP) sampler began running at the original site on a 1 in 6 (1/6) day schedule and began sampling on February 2, 2010. KDHE installed an additional HiVol TSP sampler at the Salina monitoring site to use for collocation purposes in 2013. This sampler runs on the same 1/6-day sampling schedule as the primary lead sampler. The co-located sampler was situated beside the primary. Data from these samplers are used to establish compliance with applicable National Ambient Air Quality Standards (NAAQS). The lead NAAQS requires three consecutive years of a 3-month rolling average to be equal to or below 0.15 $\mu g/m^3$ to be classified as attaining the standard. The lead monitoring site near Exide Technologies is currently a nonattainment area, but three years of clean data have passed and KDHE is working with the facility and EPA Region 7 to submit a redesignation request for the area. The current lead nonattainment area is shown in Figure 25.

Discussions about relocating the lead monitoring site were held throughout 2018 and early 2019 due to the anticipated sale of the property where the sequential samplers were located. An appropriate new location was selected approximately 90 meters east of the previous location. The move to the proposed location occurred in early October 2019 and the samplers restarted on October 6, 2019. The current location of the samplers in comparison to the Exide Technologies facility is shown in Figure 26; the old location is also noted on this figure.

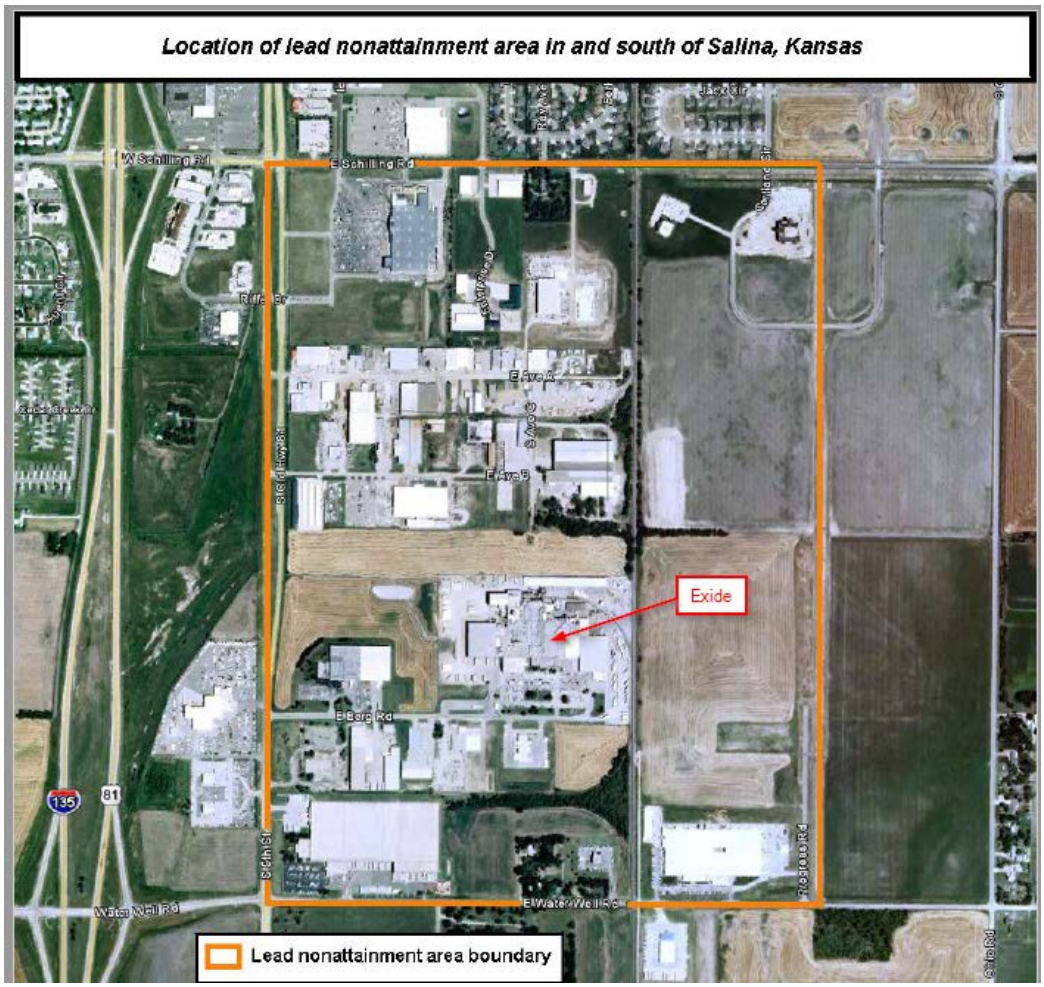


Figure 25. Location of Current Lead Nonattainment Area in and South of Salina, KS

Figure 26. Prior and New Lead Monitor Site, Salina, KS

Population Based Lead Monitoring

EPA also requires lead monitoring in large urban areas. These monitors are typically located with National Core multi-pollutant ambient monitoring sites (NCore sites). Lead monitoring at these sites began January 1, 2012. KDHE located a high volume (HiVol), total suspended particulate (TSP) sampler at the JFK NCore site in Kansas City, Kansas to fulfill this requirement. It began running on a 1 in 6-day schedule on December 27, 2011 and took its first sample on January 4, 2012. On March 28, 2016 EPA published a rule entitled "*Revisions to Ambient Monitoring Quality Assurance and Other Requirements.*" This EPA rule allowed for the discontinuance of population-based lead monitoring at NCore sites if states provided three years of data showing the monitor was below the lead standard. With more than four years of lead data showing a maximum three-month rolling average of 0.01 $\mu g/m^3$ lead monitoring at the JFK NCore site was discontinued with the last operating sample occurring on June 29, 2016.

Mercury Deposition Monitoring in Kansas

KSA 75-5673 originally required that the Kansas Department of Health and Environment (KDHE) establish a statewide mercury deposition network consisting of at least six monitoring sites. Monitoring for a period of time long enough to determine trends (five or more years) was also specified. Legislative changes were enacted in 2014 that keep a network in place but allow the KDHE to reexamine the network size and location of the original six sites as established in response to KSA 75-5673. KDHE has reconfigured the network to now include four sites across the state. These network changes will continue to assure compatibility with the national Mercury Deposition Network (MDN). The MDN, coordinated through the National Atmospheric Deposition Program (NADP), is designed to study and quantify the atmospheric fate and deposition of mercury. The MDN collects weekly samples of wet deposition (rain and snow) for analysis to determine total mercury. The current Kansas Mercury Wet Deposition Monitoring Network (KMDN) consists of four sites distributed across the state. The locations of existing and future sites in the states of Nebraska and Oklahoma were also taken into consideration to optimize regional mercury network coverage. A detailed report on the mercury network is posted to the Bureau of Air webpage; see https://www.kdheks.gov/bar/air-monitor/mercury/Hg_Report.pdf. A map of the network appears below in Figure 27. A review of the current sites will be conducted in 2020.

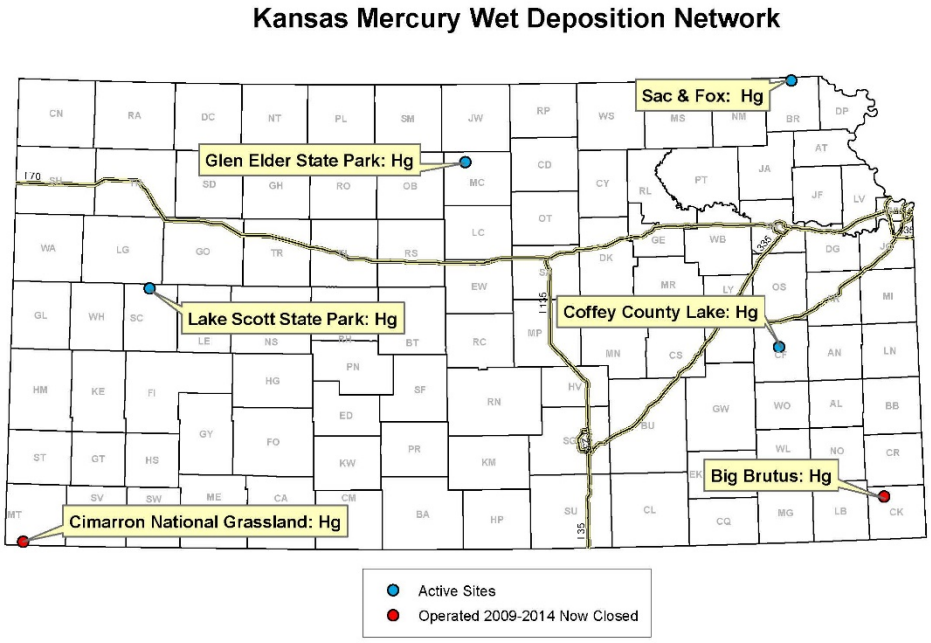


Figure 27. Mercury Wet Deposition Network (including closed sites) 2020

Sulfur Dioxide (SO_2) Monitoring Network

EPA conducted a review of the SO_2 NAAQS and decided to retain the existing primary standard in 2019. The decision was based on evidence that the standard established in 2010 protects public health with an adequate margin of safety, including the health of at-risk populations with asthma.[2] Therefore, the SO_2 standard remains at 75 parts per billion (ppb) based on the 3-year average of the 99th percentile of the yearly distribution of 1-hour daily maximum concentrations. In 2012, EPA decided to retain the current secondary standard for SO_2. The secondary SO_2 standard is 500 ppb averaged over three hours, not to be exceeded more than once per year.[3] The Kansas Air Monitoring Network includes the following four sites monitoring SO_2: Cedar Bluff, Peck, Chanute, and JFK/NCore. (Figure 28).

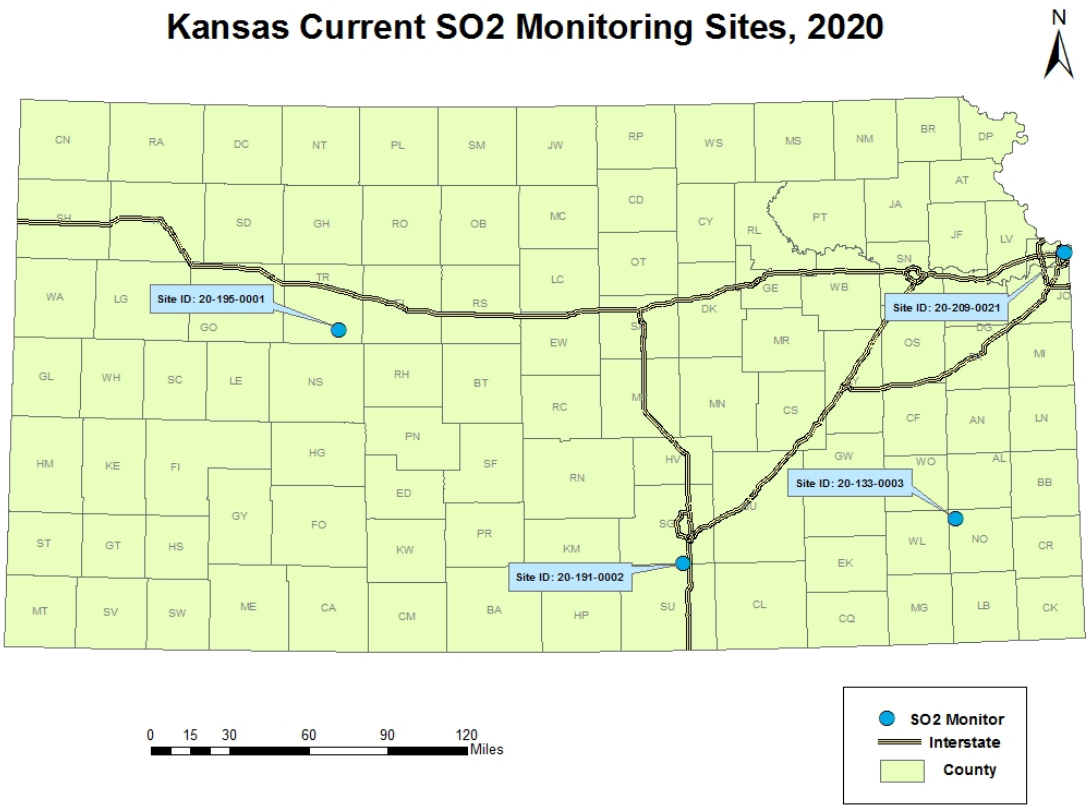


Figure 28. Current Sulfur Dioxide Monitoring Network 2020

The graph below shows an established trend of the design values for the four sites. Current design values do not approach the primary or secondary standards.

[2] https://www.epa.gov/so2-pollution/setting-and-reviewing-standards-control-so2-pollution#standards
[3] https://www.epa.gov/so2-pollution/secondary-national-ambient-air-quality-standards-naaqs-nitrogen-dioxide-no2-and-sulfur

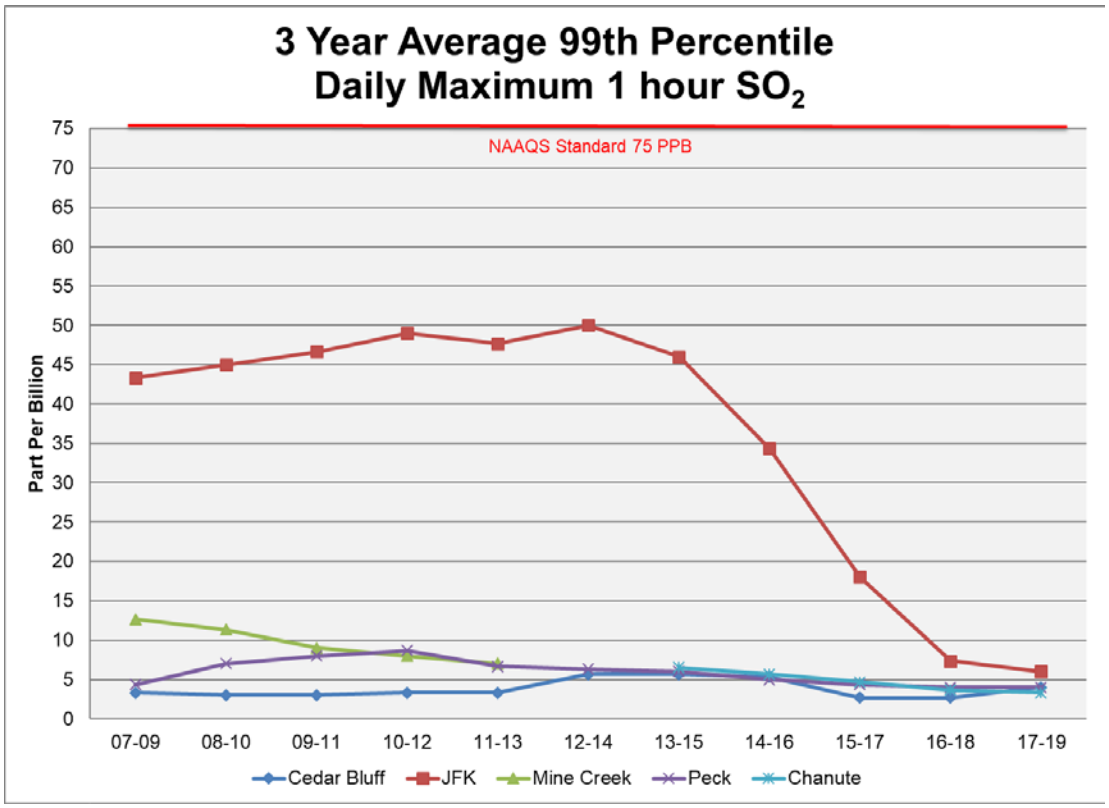


Figure 29. 3-yr Average 99th Percentile Daily Max 1-hr SO_2

Proposed Kansas Sulfur Dioxide Monitoring Network 2020–2025

KDHE will maintain the current locations for SO_2 monitoring in the network.

Nitrogen Dioxide (NO_2) Monitoring Network

On December 22, 2016 EPA removed the requirement to install near-road nitrogen dioxide (NO_2) monitoring stations in Core Based Statistical Areas (CBSAs) having populations between 500,000 and 1 million.

Based on a review of the full body of scientific evidence, EPA in 2017 decided to retain the current standards (NAAQS) for nitrogen dioxide (NO_2). The conclusion was that the current NAAQS protect the public health, including at risk populations of older adults, children, and people with asthma, with an adequate margin of safety. The primary NAAQS for NO_2 is a 1-hour standard at a level of 100 ppb based on the 3-year average of 98th percentile of the yearly distribution of 1-hour maximum concentrations. The primary and secondary annual mean standard is 53 ppb[4]

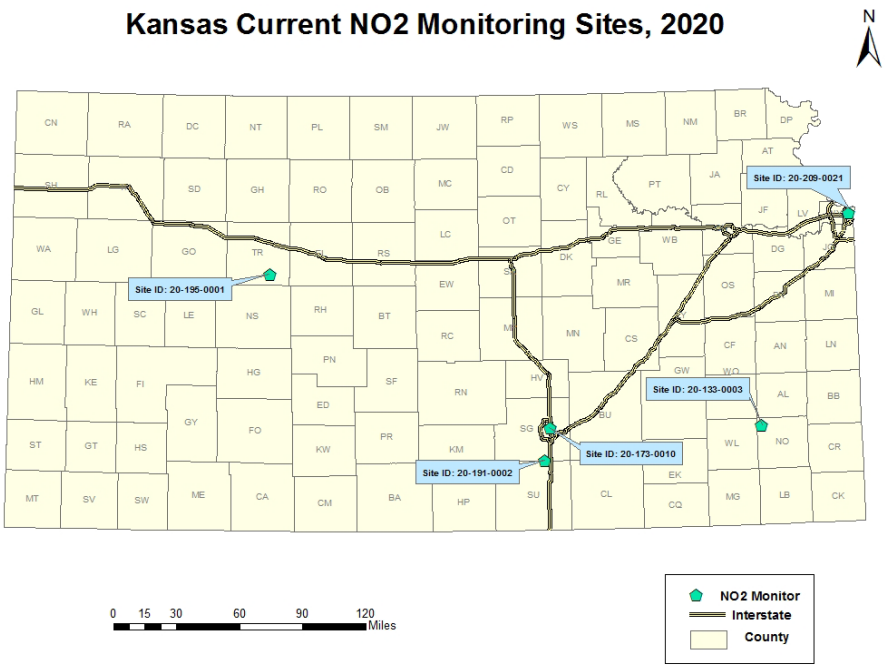


Figure 30. Kansas Current NO_2 Monitoring Sites 2020

Monitoring requirements are also established for areawide NO_2 monitoring. KDHE and MDNR cooperate to ensure that any monitoring changes that could affect the other state's monitoring network requirements are discussed and evaluated to ensure minimum requirements are met. Requirements state there must be one monitoring station in each CBSA with a population of 1,000,000 or more persons to monitor a location of expected highest NO_2 concentrations representing the neighborhood or larger spatial scales. The Kansas City CBSA is the only required area within the state of Kansas to operate an

[4] https://www.epa.gov/no2-pollution/primary-national-ambient-air-quality-standards-naaqs-nitrogen-dioxide

areawide NO_2 monitor, and this requirement is satisfied by the JFK/NCore monitoring site (AQS ID 20-209-0021). Additional NO_2 monitoring is conducted as a part of the SLAMS network at Cedar Bluff (AQS ID 20-195-0001), Peck (AQS ID 20-191-0002), Wichita Health Department (AQS ID 20-173-0010), and Chanute (AQS ID 20-133-0003). All sites meet the NAAQS for NO_2. These sites are shown in the monitoring site map in Figure 30.

Proposed Kansas Nitrogen Dioxide Monitoring Network 2020–2025

KDHE intends to maintain the current configuration of its NO_2 network in the near term. KDHE is contemplating the addition of a NO_2 monitor at our Dodge City monitoring site sometime in the future if funding becomes available. This monitor may help us assess what impacts the oil and gas industry in Texas, Oklahoma and southwest Kansas may be having on that site.

Carbon Monoxide (CO)

EPA conducted a review of the CO NAAQS and decided to retain the existing primary standard in 2011. Currently there is no secondary standard for CO. The Kansas Air Monitoring Network includes one site monitoring CO (Figure 31). It is located at the JFK/NCore site in Kansas City, KS.

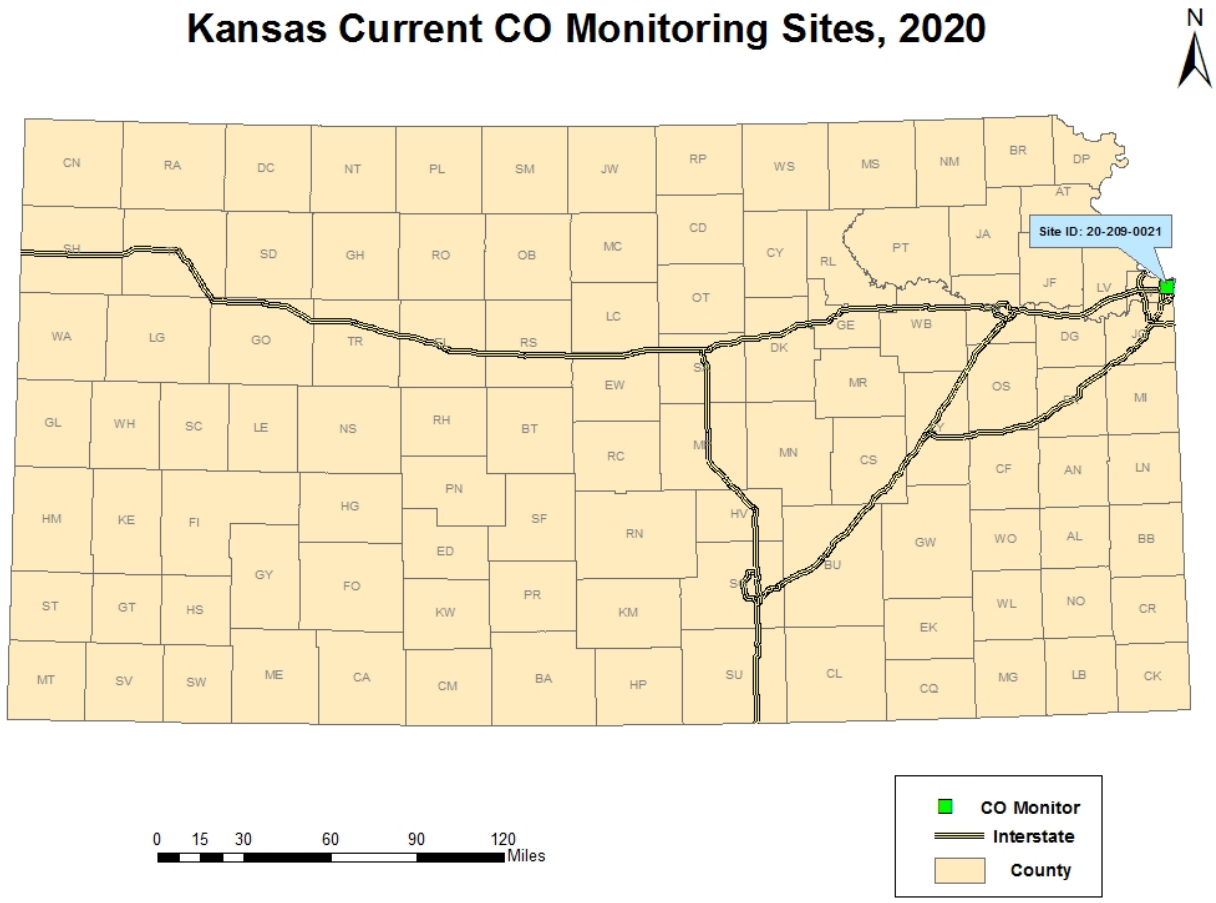


Figure 31. Current Carbon Monoxide Monitoring Site (JFK-KC, KS) 2020

The primary NAAQS for CO are:

- 9 ppm maximum for eight hours
- 35 ppm maximum for one hour

Concentrations may not be exceeded more than once per year. Figure 32 below shows the nearly 10-year trend for the annual 2nd maximum CO values, which does not approach the primary standard established in 2011.

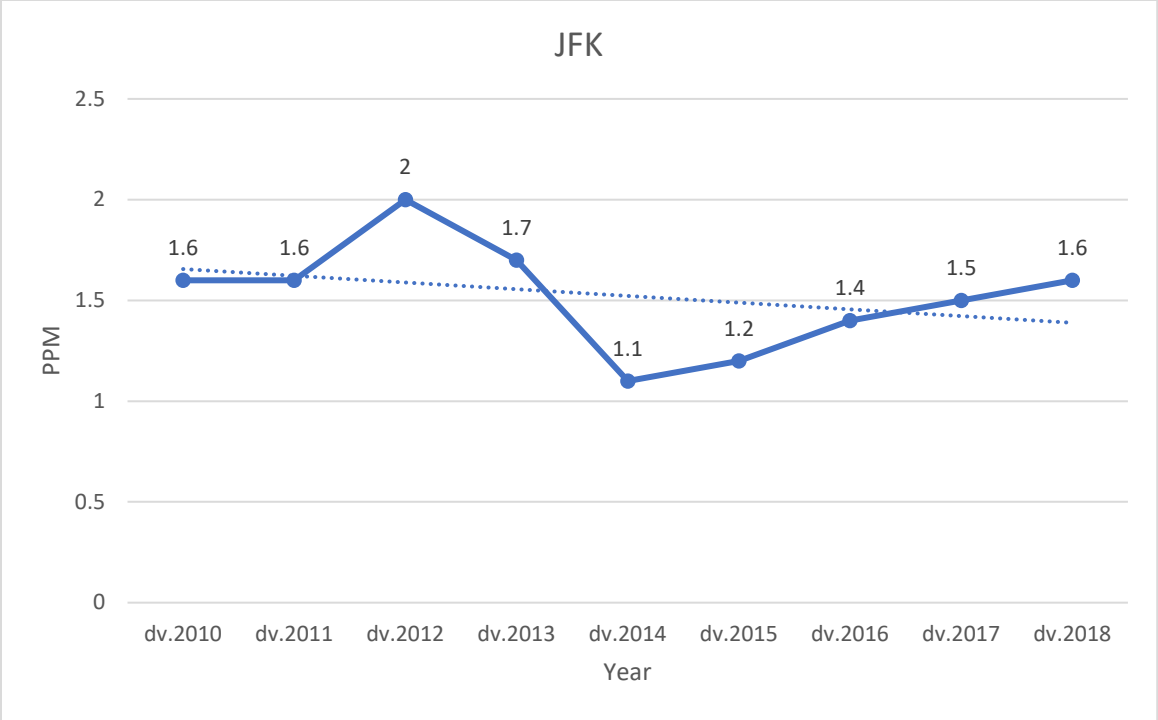


Figure 32. Carbon Monoxide Design Values 2010–2018

Proposed Kansas Carbon Monoxide Monitoring Network 2020–2025

KDHE will maintain the current location for CO monitoring in the network to maintain the NCore minimum requirements.

APPENDIX A

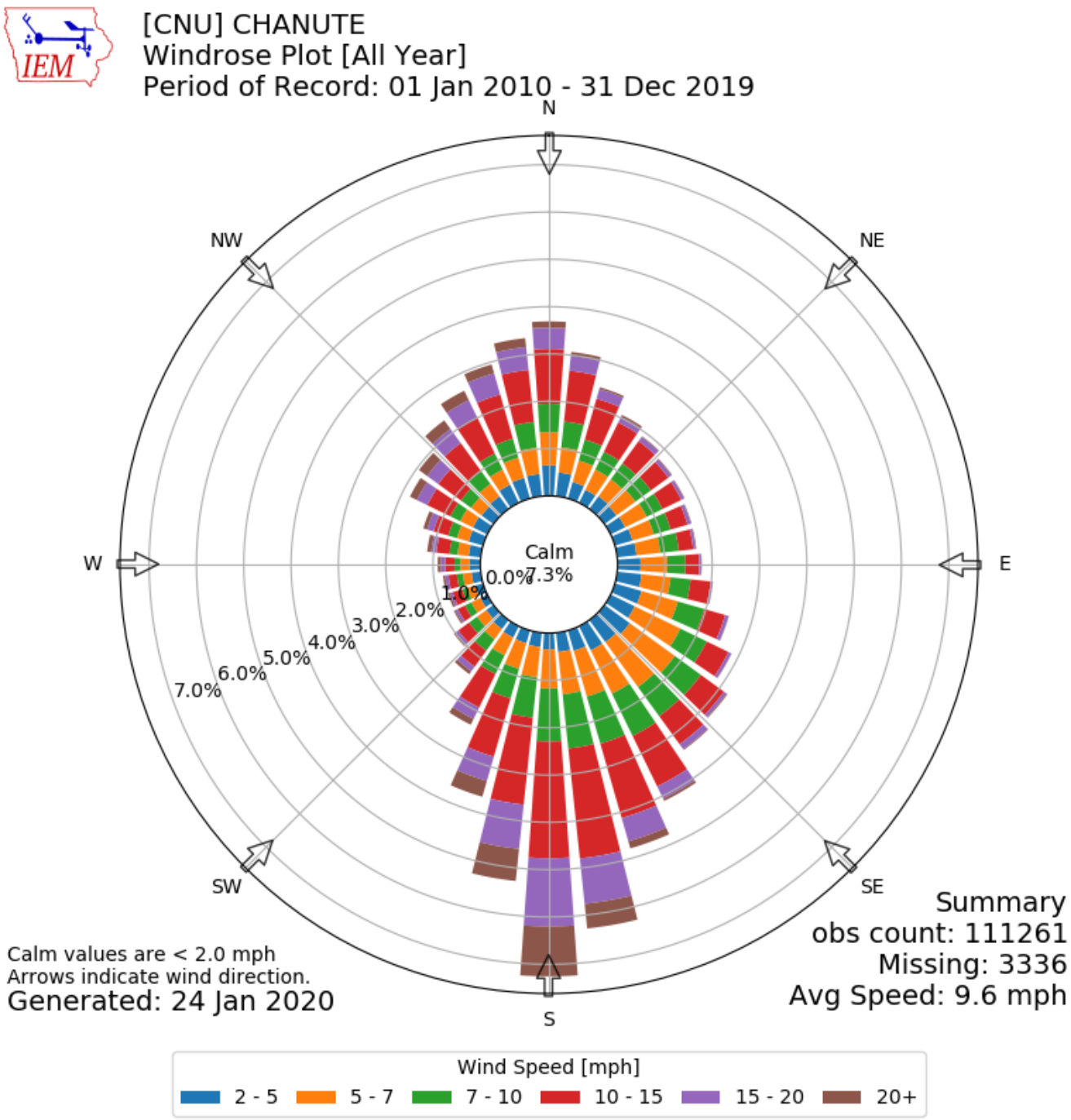


Figure 1. Chanute ASOS Wind Rose 2010 - 2019

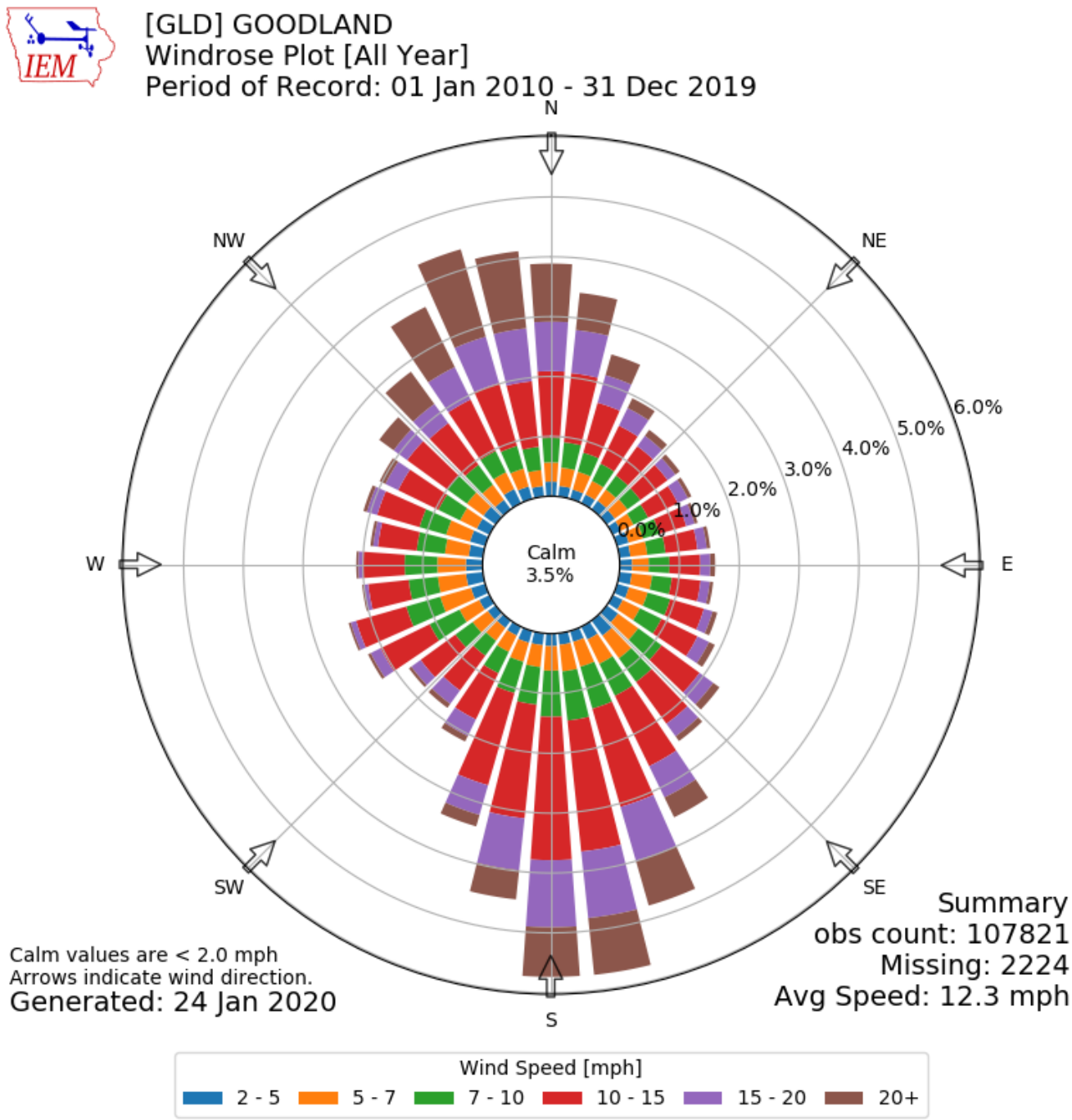


Figure 2. Goodland ASOS Wind Rose 2010 - 2019

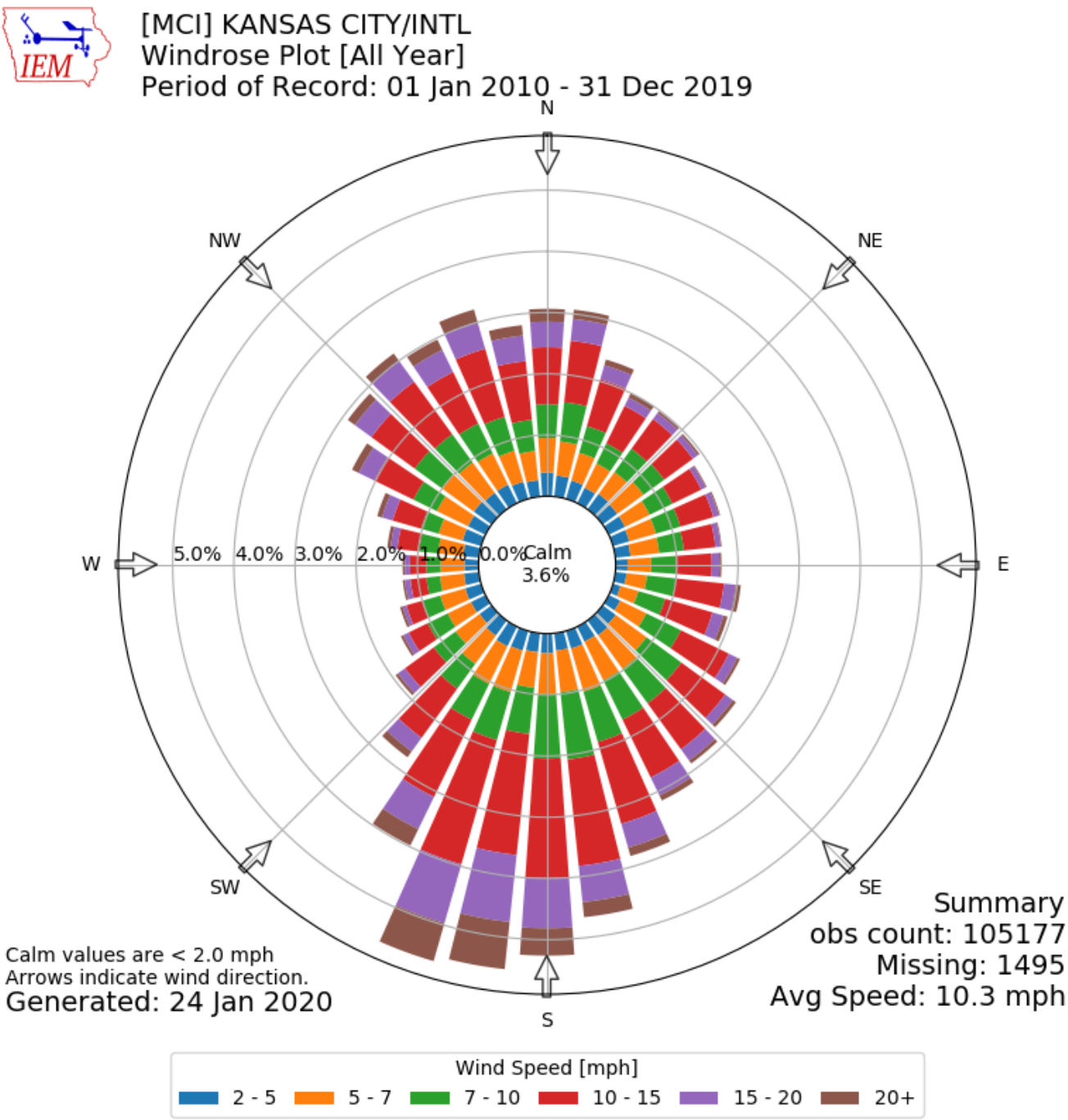


Figure 3. Kansas City International ASOS Wind Rose 2010 - 2019

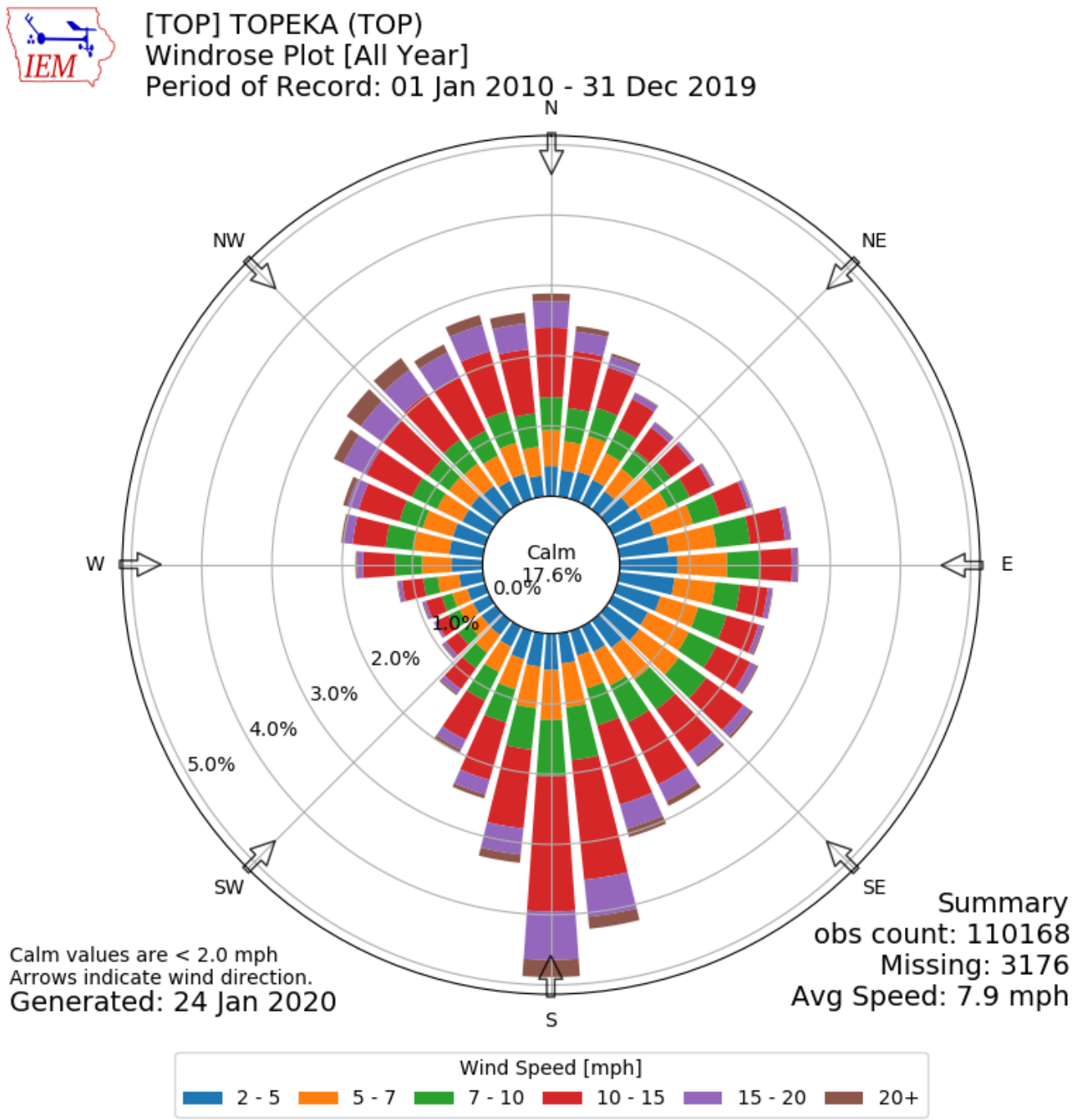


Figure 4. Topeka ASOS Wind Rose 2010 - 2019

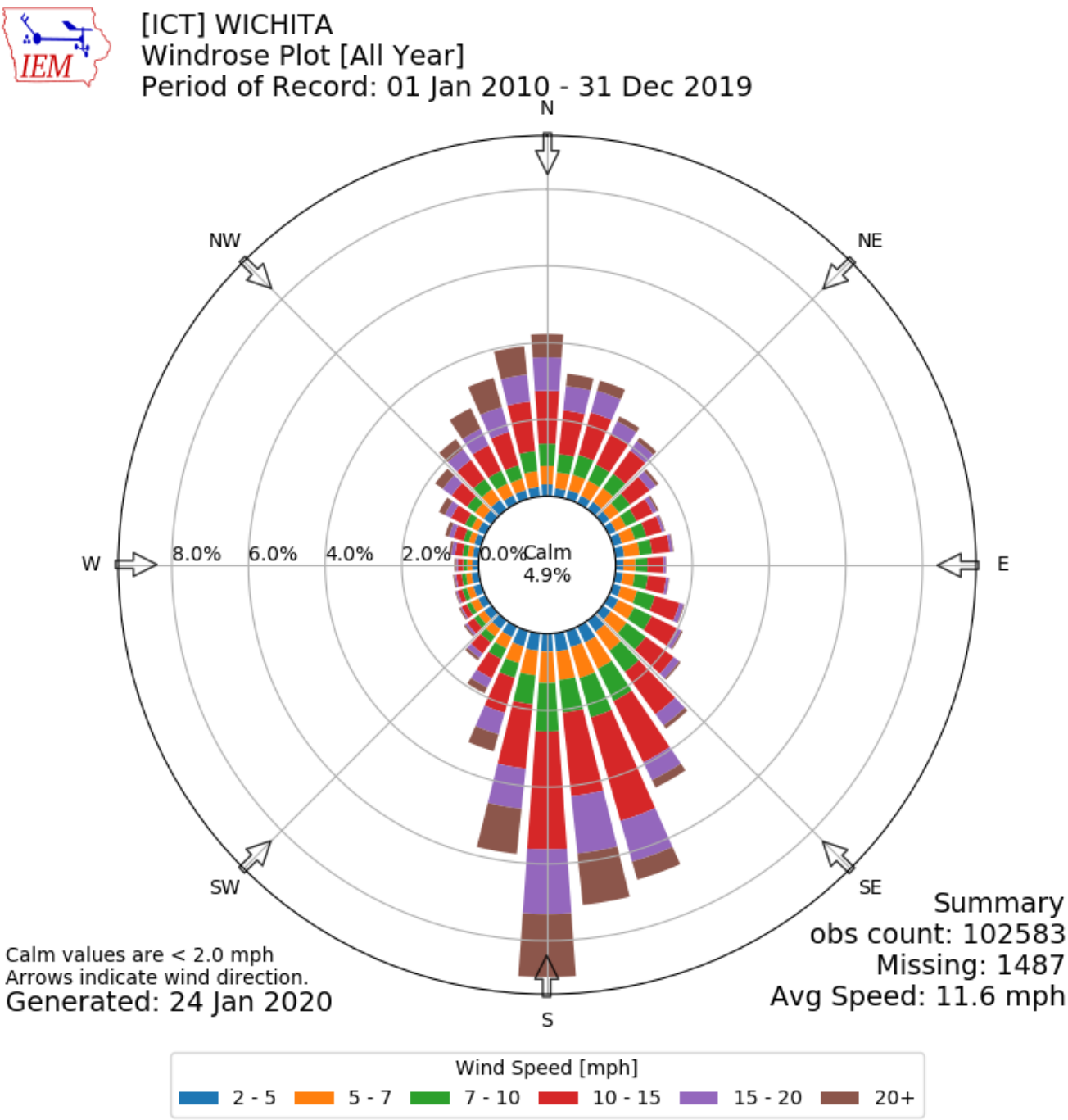


Figure 5. Wichita ASOS Wind Rose 2010 - 2019

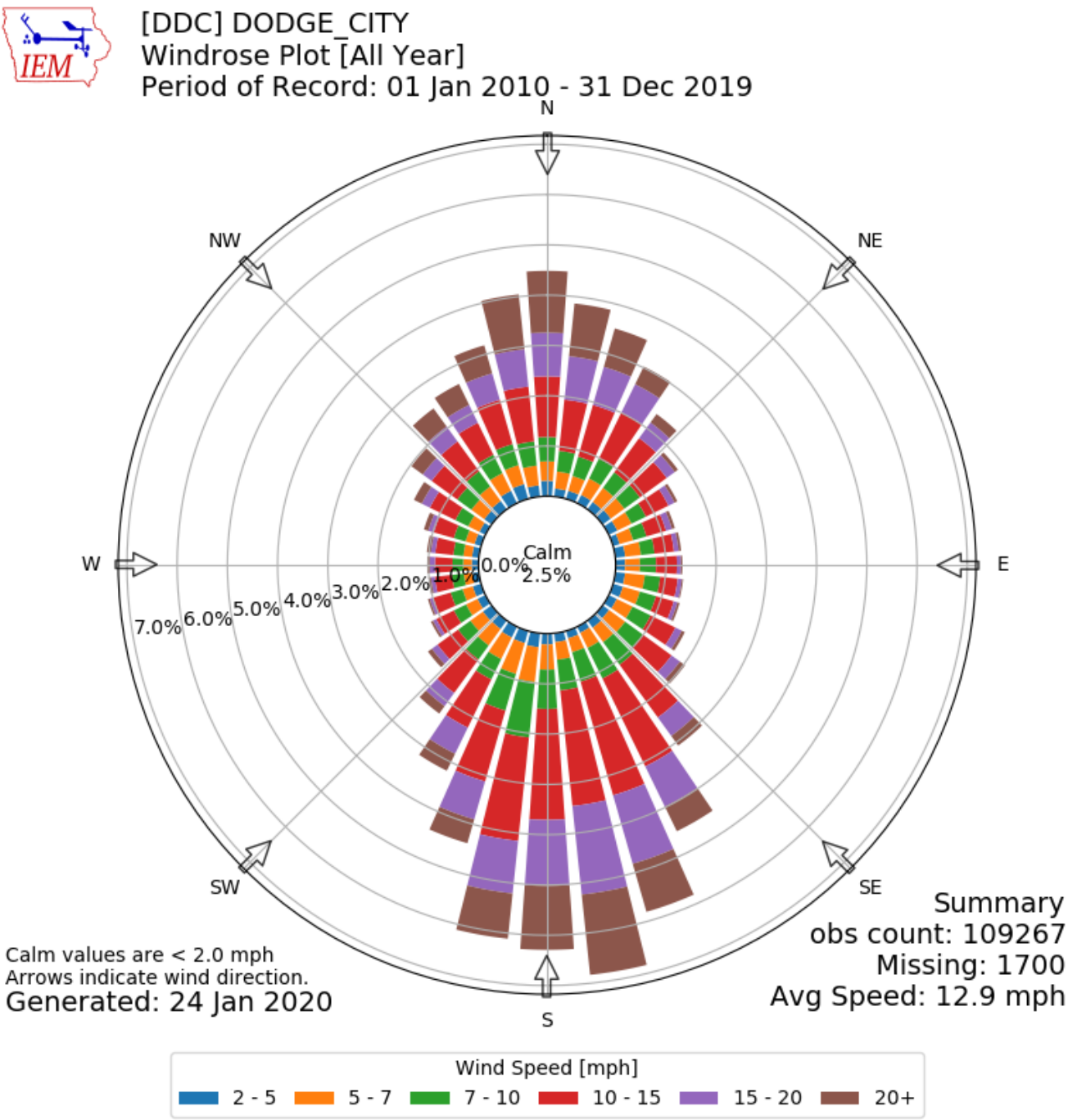


Figure 6. Dodge City ASOS Wind Rose 2010 - 2019

APPENDIX B

Kansas MSA and CSA Population Data

Metropolitan Statistical Area	2018 Estimate	2010 Population	Percent Change (2010–2018)
Kansas City, MO-KS MSA	2,143,651	2,009,342	+6.68%
Lawrence, KS MSA	121,436	110,826	+9.57%
Manhattan, KS MSA	97,980	92,719	+5.67%
St. Joseph, MO-KS MSA	126,490	127,329	-0.66%
Topeka, KS MSA	232,594	233,870	-0.55%
Wichita, KS MSA	644,888	630,919	+2.21%

Combined Statistical Area	2018 Estimate	2000 Population	Percent Change (2010–2018)
Kansas City-Overland Park-Kansas City, MO-KS CSA	2,487,053	2,343,008	+6.15%
Wichita-Arkansas City-Winfield, KS CSA	672,796	659,372	+2.04%

http://en.wikipedia.org/wiki/Table_of_United_States_Metropolitan_Statistical_Areas
http://en.wikipedia.org/wiki/Table_of_United_States_Combined_Statistical_Areas

APPENDIX C

Kansas Micropolitan Statistical Areas Population Data

Micropolitan Statistical Area	2018 Estimate	2010 Population	Percent Change (2010–2018)
Atchison µSA	16,193	16,924	-4.32%
Coffeyville µSA	32,120	35,471	-9.45%
Dodge City µSA	33,888	33,848	+0.12%
Emporia µSA	33,406	33,690	-0.84%
Garden City µSA	40,554	40,753	-0.49%
Great Bend µSA	26,111	27,674	-5.65%
Hays µSA	28,710	28,452	+0.91%
Hutchinson µSA	62,342	64,511	-3.36%
Junction City µSA	32,594	34,362	-5.15%
Liberal µSA	21,780	22,952	-5.11%
McPherson µSA	28,537	29,180	-2.20%
Ottawa µSA	25,631	25,992	-1.39%
Parsons µSA	19,964	21,607	-7.60%
Pittsburg µSA	39,019	39,134	-0.29%
Salina µSA	60,203	61,697	-2.42%
Arkansas City-Winfield µSA	35,218	36,311	-3.01%

http://en.wikipedia.org/wiki/Table_of_United_States_Micropolitan_Statistical_Areas

APPENDIX D

The following contains a table of the latest emission inventory for individual sources in the state and a map of Title V and PSD permitted facility source locations in the state.

2018 Kansas Title V Facility Emissions (tons/yr)

Facility ID	Title V Facility *(current 2020 owner name)*	NAICS Code	CO	NO_x	PM_{10}	$PM_{2.5}$	SO2	VOC	Total HAP
0010004	Southern Star Central - Humboldt Station	486210	6.4	24.8	0.5	0.5	0.0	0.8	0.1
0010009	Monarch Cement	327310	1,976.6	1,618.0	119.9	10.5	13.3	63.6	11.6
0010042	Allen Co. Landfill	562212	4.6	0.2	0.1	0.1	0.1	1.5	1.9
0030009	Southern Star Central - Welda Station	486210	19.3	90.8	1.7	1.7	0.1	6.0	0.7
0050002	MGPI Processing	312140	135.7	59.9	54.6	13.3	18.0	60.2	9.9
0050020	Bradken - Atchison/St. Joseph	331513	92.8	20.8	28.5	17.5	3.4	77.0	13.1
0050037	We-Mac Mfg. - Atchison	332420	0.0	0.0	2.4	0.1		13.6	2.7
0070031	ONEOK - Okmar Station	211130	20.9	13.6	1.0	1.0	0.1	71.3	9.9
0070048	ONEOK - Medicine Lodge Station	211130	52.6	136.3	1.4	1.4	0.1	66.9	12.4
0090002	Sunflower Electric - Great Bend	221112	0.2	1.0	0.1	0.1	0.0	0.0	0.0
0090031	Natural Gas Pipeline of America - Heizer Station 104	486210	83.2	338.9	4.3	4.3	0.1	11.6	5.6
0090069	Glass King Mfg.	326199			0.0			2.1	2.1
0090070	McDonald Tank & Equipment	326199			0.1			15.0	12.7
0110014	Peerless Products	332321	0.6	0.7	0.1	0.1	0.0	0.0	
0150004	HollyFrontier El Dorado Refinery	324110	598.6	854.7	174.8	159.6	96.8	804.2	98.3
0150009	Augusta Mun. Power Plant #1	221112	0.0	0.1	0.0	0.0	0.0	0.0	0.0
0150010	Augusta Mun. Power Plant #2	221112	7.6	40.7	0.9	0.8	0.0	3.0	0.0
0150027	Sherwin-Williams - Andover	325510	0.8	1.0	1.0	1.0	0.0	21.9	8.4
0150029	Holly Energy Partners - El Dorado Tank Farm	486110						37.0	1.5
0150036	Pioneer Balloon	323111	0.6	0.7	0.1	0.1	0.0	26.9	1.0
0150041	Butler Co. Sanitary Landfill	562212	11.2	0.6	0.3	0.3	0.2	1.1	2.2

0210002	Empire District Electric - Riverton	221112	21.4	163.5	22.1	22.1	2.9	0.7	4.8
0210023	Jayhawk Fine Chemicals Corp.	325199	8.3	188.0	0.8	0.6	0.1	18.0	11.6
0210026	Bagcraft Papercon	322220	0.2	0.3	0.0	0.0	0.0	19.7	0.7
0230013	Southern Star Central - St. Francis Station	486210	13.4	108.2	1.7	1.7	0.0	12.0	2.6
0270001	Northern Natural Gas - Clifton Station	486210	61.1	296.0	5.5	5.5	2.0	17.8	3.3
0270007	Clay Center Mun. Power Plant	221112	3.7	5.3	0.2	0.2	0.0	0.6	0.1
0290009	Cloud Ceramics	327120	28.2	8.2	24.8	16.4	15.7	1.3	1.0
0290010	Natural Gas Pipeline of America - Glasco Station 105	486210	211.8	812.6	8.8	8.8	0.6	26.9	11.9
0290028	NuStar Pipeline - Concordia Products Breakout Terminal	486910						115.3	6.5
0330001	ANR Pipeline - Buttermilk Station	486210	11.9	46.0	1.0	1.0	0.5	0.3	0.1
0350012	Winfield Mun. Power Plant #2	221112	2.1	7.1	0.2	0.2	0.0	0.1	0.0
0350031	GE Engine Services - Strother South	336412	10.2	21.6	2.9	2.9	2.3	55.7	2.2
0350032	Greif Packaging - Winfield	332439	0.5	0.6	0.0	0.0	0.0	19.5	1.0
0350036	CRCT - Hooser Station	486110						33.5	2.5
0370031	Kendall Packaging	323111	0.1	0.2	0.0	0.0	0.0	173.3	0.4
0370039	Oak Grove Landfill	562212	34.6	1.8	0.8	0.8	0.7	4.0	0.6
0377039	Oak Grove Power Producers	221118	126.2	34.3	12.8	12.8	1.9	4.1	1.8
0410008	ANR Pipeline - Enterprise Station	486210	95.0	991.7	3.1	3.1	0.2	36.5	22.3
0430001	GROWMARK - St. Joseph Products Breakout Terminal	424710						78.9	4.1
0450006	API Americas	322220	1.9	2.3	0.3	0.2	0.0	22.4	8.1
0450013	ICL Specialty Products	325998	28.4	33.8	49.7	15.3	0.2	1.9	0.6
0450014	Evergy - Lawrence	221112	3,827.0	2,152.4	269.8	140.8	341.7	50.6	4.1
0450055	Chemtrade Phosphorus Specialties	325180	0.7	0.9	5.0	0.1	4.9	0.0	0.0
0450065	Kansas EPS	326140	0.4	0.5	1.5	1.5	0.0	83.9	2.5
0470012	Natural Gas Pipeline of America - Kinsley Station 193	486210	0.8	1.0	0.1	0.1	0.0	0.1	
0510060	Hess Services - Hays (230th Ave)	326199			16.4			55.3	14.5
0530001	Natural Gas Pipeline of America - Wilson Station 194	486210	69.5	115.0	2.6	2.6	1.3	21.9	

0530002	ONEOK Hydrocarbon - Bushton Complex (fractionator)	211130	142.6	100.7	54.4	53.5	4.1	67.1	5.3
0530024	Moly Manufacturing LLC	332323	0.0	0.1	0.0	0.0	0.0	1.4	0.0
0550009	WTG Hugoton - Finney Co. #4 Station	486210	28.7	32.1	0.6	0.6	0.0	6.0	1.0
0550023	Sunflower Electric - Holcomb	221112	690.8	1,583.1	151.6	96.6	1,004.1	11.5	4.2
0550024	WTG Hugoton - Finney Co. #2 Station	486210	84.7	490.8	2.0	2.0	0.1	38.1	13.2
0550026	Sunflower Electric - Garden City	221112	9.9	72.9	1.9	1.9	0.0	1.0	1.5
0550043	Tyson Fresh Meats - Holcomb	311611	49.2	56.3	63.2	58.2	0.8	33.2	1.8
0550055	Palmer Mfg. & Tank	332420			4.1	1.2		29.7	22.9
0550062	Western Plains Reg. Landfill	562212	9.0	0.3	4.1	1.5	0.0	4.1	1.8
0570001	Sunflower Electric - Fort Dodge	221112	1.9	3.0	0.2	0.2	0.0	0.1	0.0
0570003	Koch Fertilizer Dodge City	325311	547.0	215.5	94.7	15.7	1.5	24.3	23.5
0570012	Natural Gas Pipeline of America - Minneola Station 103	486210	156.2	1,039.8	5.3	5.3	0.9	246.2	6.0
0570013	National Beef Packing - Dodge City	311611	68.7	63.2	61.9	48.4	0.7	22.8	1.2
0570030	Cargill Meat Solutions - Dodge City	311611	53.3	32.9	4.9	4.9	131.5	3.5	0.9
0590006	Ottawa Mun. Power Plant	221112	14.9	35.0	0.7	0.7	0.0	2.6	0.2
0590018	Southern Star Central - Ottawa Station	486210	3.6	12.6	0.3	0.3	0.0	2.4	0.0
0590022	KPC Pipeline - Ottawa Station	486210	14.8	9.6	0.1	0.1	0.0	0.1	0.1
0590035	Schuff Steel Midwest	332312			1.2	0.3		8.5	1.6
0590043	LTA II Mfg.	336214	0.3	0.4	0.8	0.0	0.0	39.0	13.9
0670007	Birla Carbon USA	325180	1,125.5	416.9	23.5		1,231.5	42.8	3.9
0670017	Scout Energy - Satanta A Station	486210	82.1	57.2	0.5	0.5	0.0	1.9	1.2
0670024	Scout Energy - Ulysses West C Station	486210	66.6	50.1	1.1	1.1	0.1	18.8	10.5
0670025	Panhandle Eastern Pipe Line - Columbian Booster Station	486210	34.4	276.7	4.3	4.3	0.1	17.0	7.3
0670026	DCP Operating - Ulysses Station	211130	48.9	56.4	1.2	1.2	0.0	27.9	1.1
0670029	Southern Star Central - Hugoton Station	486210	69.3	461.4	7.4	7.4	0.3	19.5	9.1
0670030	Scout Energy - Ulysses South Main Station	211130	44.2	345.2	3.6	3.6	0.1	22.1	8.4
0670032	Scout Energy - Ulysses West Main Station	211130	99.6	661.2	7.5	7.5	0.2	66.7	22.6

0670049	Scout Energy - Satanta Gas Plant	211130	197.6	224.5	2.5	2.5	1.9	32.7	7.4
0670173	Sunflower Electric - Rubart	221112	3.2	9.3	1.8	1.8	0.0	0.6	0.7
0690011	Southern Star Central - Montezuma Station	486210	21.7	178.3	2.7	2.7	0.0	10.0	4.4
0730014	KPC Pipeline - Beaumont Station	486210	21.3	13.8	0.1	0.1	0.0	0.2	0.1
0750009	ETC Texas Pipeline - Hugoton #5 Station	486210	97.1	59.4	0.5	0.5		0.8	0.7
0750012	ONEOK - Bradshaw Station	211130	50.3	86.9	1.7	1.7	0.0	28.6	6.1
0770001	ONEOK - Spivey Station	486210	68.9	516.2	6.0	6.0	0.1	26.6	9.7
0770002	Anthony Mun. Power Plant	221112	1.0	2.3	0.0	0.0	0.0	0.2	
0770038	Plumb Thicket Landfill (Waste Connections)	562212	34.1	6.3	16.5	3.9	6.0	3.7	3.0
0790001	Southern Star Central - Hesston Station	486210	56.3	416.3	6.9	6.9	0.1	19.0	10.9
0790021	Agco Corp.	333111	4.5	8.5	16.1	0.7	0.1	34.3	7.1
0790045	Mid Continent Cabinetry	337110	1.6	2.0	33.2	33.2		234.6	31.4
0810007	ONEOK - Haskell Co. #1 Station	486210	18.2	22.6	3.5	3.5	0.1	34.7	4.6
0810012	Scout Energy - Ulysses Sublette Main Station	211130	56.6	341.8	4.1	4.1	0.1	32.8	14.4
0810015	Panhandle Eastern Pipe Line - Satanta Station	211130	97.1	136.9	1.8	1.8	0.0	21.4	2.8
0870025	Hamm Sanitary Landfill	562212	0.6	0.5	0.2	0.2	0.1	20.0	7.6
0910010	SPX Cooling Technologies	333415	0.7	1.0	0.6	0.1	0.0	108.7	1.3
0910055	Transcontinental Robbie Inc.	323111	0.7	0.8	0.1	0.1	0.0	183.0	0.0
0910057	AGC Flat Glass	327211	9.4	586.9	9.7		127.7	12.8	0.0
0910074	Packaging Products	323111	0.4	0.5	0.0	0.0	0.0	125.5	0.0
0910077	Vestcom New Century	323111	4.8	5.7	0.4	0.4	0.0	2.9	0.1
0910117	Deffenbaugh Ind. - Johnson Co. Landfill	562212	133.1	31.3	18.8	18.8	6.5	17.6	13.0
0910174	Evergy - West Gardner	221112	4.3	7.7	1.9	1.9	0.2	0.6	0.3
0910249	Engineered Air	333415	0.1	0.1	1.6	1.6	0.0	9.8	4.1
0930005	ETC Texas Pipeline - Hugoton #3 Station	486210	277.3	169.5	1.5	1.5		2.2	2.2
0930008	WTG Hugoton - Tate Station	486210	209.2	133.5	1.5	1.5	0.1	15.5	3.4
0930010	Scout Energy - Ulysses North Main Station	211130	77.8	379.4	4.3	4.2	0.1	35.9	13.1

0937055	Colorado Interstate Gas - Lakin Station	486210	1.2	8.8	0.1	0.1	0.0	0.3	0.2
0950002	ONEOK - Cheney Gas Plant	211130	111.5	798.1	2.1	2.1	0.1	69.7	13.3
0950004	Kingman Mun. Power Plant	221112	3.1	36.1	1.0	1.0	0.0	3.6	0.3
0950023	Kansas Gas Service - Calista Station	486210	2.3	13.2	0.2	0.2	0.0	4.3	0.3
0970009	ANR Pipeline - Greensburg Station	486210	63.2	1,218.8	3.0	3.0	0.2	35.3	21.5
0970010	Northern Natural Gas - Mullinville Station	486210	220.1	881.0	14.0	14.0	1.8	31.6	17.3
0970011	Panhandle Eastern Pipe Line - Greensburg Station	486210	12.2	9.9	0.8	0.8	0.2	4.2	0.1
0990037	CST Storage	332420	2.0	3.8	8.6	8.6	0.0	53.0	5.0
0990041	Grandview Products	337110			5.2			87.1	18.9
0990065	Dayton Superior - Parsons	331222	0.5	0.6	0.5	0.0	0.0	0.2	0.1
1030011	Southern Star Central - Tonganoxie Station	486210	2.3	17.5	0.3	0.3	0.0	3.6	0.4
1030134	Henke Mfg.	333120	0.1	1.9	2.1	0.0	0.0	8.6	
1070005	Evergy - La Cygne	221112	399.4	2,791.9	320.2	156.4	566.6	135.1	26.4
1110006	Southern Star Central - Americus Station	486210	24.9	203.5	3.1	3.1	0.0	10.6	5.0
1110007	Panhandle Eastern Pipe Line - Olpe Station	486210	192.6	898.5	16.7	16.7	2.2	57.2	20.7
1110008	Bunge North America - Emporia (E 6th)	311224	24.2	16.6	41.5	19.0	0.2	296.1	187.1
1110036	Camso Mfg. USA	326291	2.5	4.0	1.6	1.1	0.0	21.9	12.8
1110046	Evergy - Emporia	221112	82.7	225.9	19.7	19.7	1.9	6.3	3.0
1110051	City of Emporia Solid Waste Transfer Station	562111	5.1	8.5	29.7	27.9	0.3	0.3	
1130003	CHS McPherson Refinery	324110	283.6	811.0	174.8	106.9	33.5	330.9	66.8
1130014	McPherson Mun. Power Plant #2	221112	8.9	178.0	1.0	1.0	0.1	1.0	0.1
1130019	Mid-Continent Fractionation & Storage - Conway Fractionator	211130	147.6	307.3	10.5	10.5	1.5	273.2	7.3
1130036	Johns Manville - McPherson	327993	639.8	17.6	142.5	141.4	2.8	132.0	0.0
1130046	McPherson Mun. Power Plant #3	221112	2.6	24.6	0.6	0.6	0.1	0.7	
1130074	McPherson Area Solid Waste Transfer Station	562111	1.4	2.2	1.5		0.1	3.7	
1170021	GP Industrial Plasters	327420	12.6	15.0	100.2	1.2	0.1	1.0	0.1
1190014	ANR Pipeline - Meade Station	486210	47.3	799.5	2.0	2.0	0.1	23.1	14.1

1190025	Panhandle Eastern Pipe Line - Borchers Station	486210	48.9	353.8	5.8	5.8	0.1	31.6	8.1
1210003	Phillips 66 Carrier - Paola Products Pipeline Station	486910	113.5	107.8	5.3	5.2	0.4	32.4	2.4
1210015	Panhandle Eastern Pipe Line - Louisburg Station	486210	287.4	2,355.3	36.0	36.0	0.5	92.3	57.5
1210030	Evergy - Osawatomie	221112	1.3	2.5	0.6	0.6	0.1	0.2	0.1
1230012	Beloit Mun. Power Plant	221112	0.1	1.0	0.0	0.0	0.0	0.1	
1250002	Coffeyville Mun. Power Plant #1	221112	9.5	17.6	0.9	0.9	0.1	0.6	0.2
1250003	CRRM Refinery	324110	684.0	375.7	130.0	130.0	93.5	725.9	38.9
1250005	Southern Star Central - Grabham Station	486210	102.7	900.8	11.7	11.7	0.2	36.8	20.8
1250007	Acme Foundry	331511	209.3	6.6	41.2	3.7	21.1	132.0	4.6
1250020	MFG Const. Products	326199						7.0	6.8
1250049	Emerald Transformer PPM	562211	0.5	0.6	3.0	0.0	0.0	0.0	
1250054	Forte Products - Cherryvale (1127 N Liberty)	326191	0.9	1.1	0.5	0.1	0.0	14.1	11.2
1250056	Magellan Pipeline - Independence Pump Station	486910	8.1	66.9	1.4	1.4	0.4	5.0	
1250059	CRCT - Broome Station	486110						111.8	9.3
1250063	Textron Aviation - Independence	336411	2.5	3.0	0.3	0.3	0.0	11.9	1.1
1250079	CRNF - Coffeyville	325311	267.2	117.1	17.0	4.3	83.3	26.6	24.0
1290005	ETC Texas Pipeline - Greenwood #2 Station	486210	137.7	84.1	0.7	0.7		1.1	1.0
1290008	WTG Hugoton - Morton Co. #1 Station	486210	185.6	110.3	1.0	1.0	0.0	21.8	5.2
1297127	Colorado Interstate Gas - Morton Co. Station	486210	20.6	147.3	0.4	0.4	0.0	4.3	1.9
1330001	Ash Grove Cement - Chanute	327310	482.7	844.9	217.4	9.5	258.0	27.6	92.4
1330027	HBD/Thermoid	326220	1.0	1.1	0.1	0.1	0.0	4.7	4.6
1330028	Chanute Mun. Power Plant #3	221112	0.5	39.5	0.8	0.8	0.0	2.9	0.3
1330030	Chanute Mun. Power Plant #2	221112	2.2	14.9	1.0	1.0	0.1	0.4	0.1
1410023	Osborne Industries	326199						6.6	6.5
1430001	Northern Natural Gas - Tescott Station	486210	24.0	93.7	1.9	1.9	1.0	3.9	0.2
1430025	Tallgrass Interstate - Tescott Station	486210	7.4	8.2	0.7	0.7	0.0	14.4	
1450016	Northern Natural Gas - Macksville Station	486210	51.0	195.8	4.1	4.1	2.1	2.0	0.4

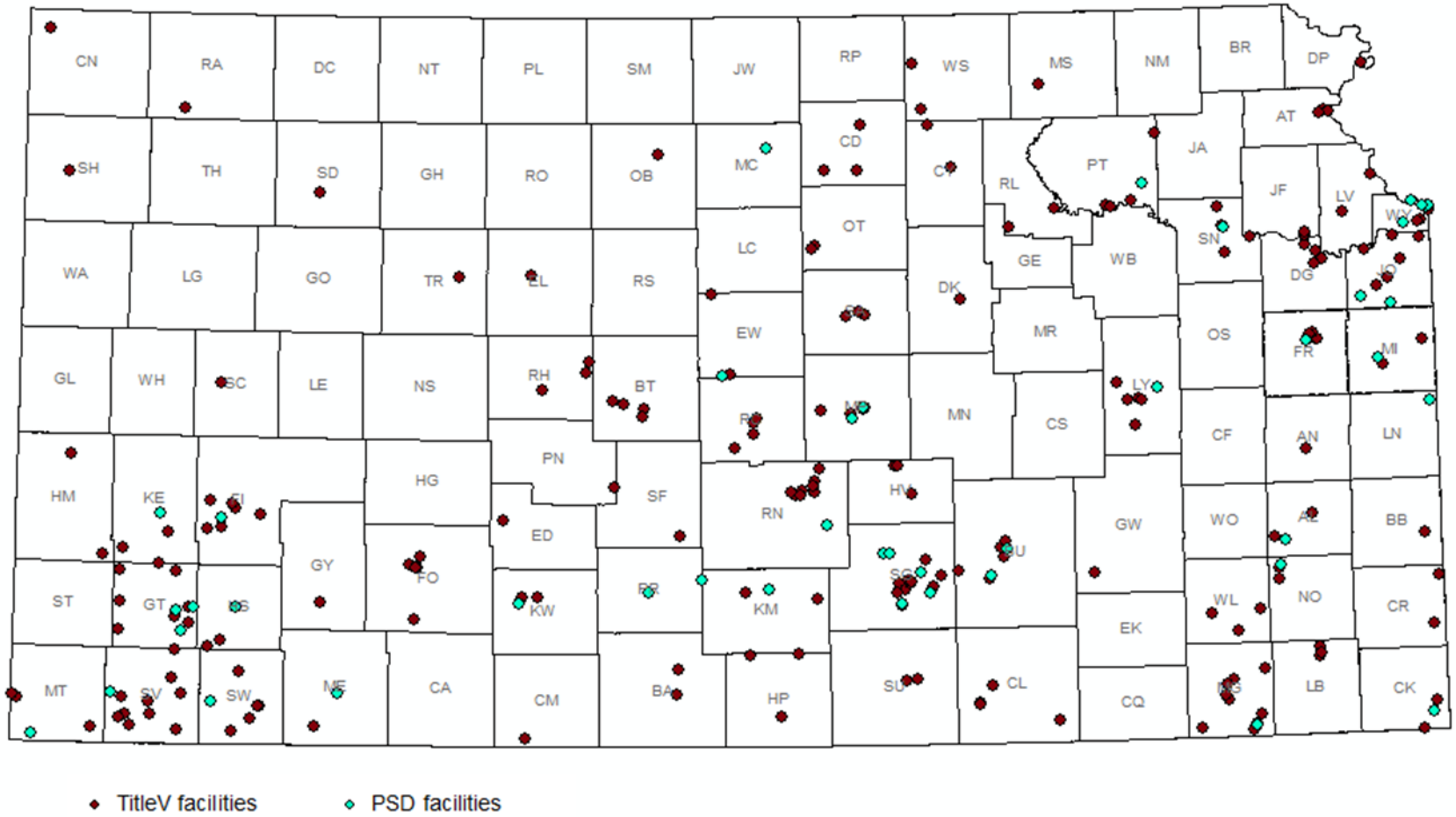
1490001	Evergy - Jeffrey	221112	9,320.6	4,588.9	900.7	716.0	1,474.9	192.2	15.1
1490012	Wamego Mun. Power Plant	221112	0.5	2.9	0.1	0.1	0.0	0.2	
1490016	ANR Pipeline - Havensville Station	486210	96.3	788.4	12.0	12.0	0.1	29.2	19.8
1490020	Onyx Collection	326191						307.0	307.0
1490041	City of Wamego Public Works (air curt comb)	562213	0.3	0.6	0.3		0.0	0.8	
1510018	Northern Natural Gas - Cunningham Station	486210	6.9	33.0	0.9	0.9	0.1	19.2	3.0
1530014	Southern Star Central - Levant Station	486210	23.9	194.5	3.0	3.0	0.0	10.0	4.7
1550008	Panhandle Eastern Pipe Line - Haven Station	486210	166.5	877.9	12.7	12.7	0.2	52.1	20.2
1550009	Kuhn Krause Inc.	333111		0.0	0.3		0.0	27.9	1.4
1550011	ONEOK Hydrocarbon - Hutchinson Fractionator	211130	64.0	70.5	20.3	20.3	1.8	36.2	3.7
1550033	Evergy - Hutchinson	221112	7.3	52.1	0.6	0.6	0.8	0.8	0.1
1550063	Sonoco-Hutchinson	322130	22.8	75.9	6.4	2.1	0.2	59.4	2.5
1550066	NuStar Pipeline - Hutchinson Products Breakout Terminal	486910	0.3	0.1				43.9	2.9
1550071	Collins Bus - South Hutchinson	336211	0.7	0.8	1.9	0.1	0.0	52.2	3.5
1550089	Lowen Corp.	323111						8.3	1.0
1550110	Reno Co. Landfill	562212	72.9	10.0	2.1	2.1	1.7	4.3	2.6
1550122	Ade-Wifco Steel Products	332311	0.3	1.4	9.0	0.1	0.0	53.3	0.9
1590005	Compass Minerals America	311942	45.2	53.9	15.2	9.0	0.3	3.0	1.0
1590007	Northern Natural Gas - Bushton Station	486210	128.5	1,325.8	7.8	7.8	5.3	58.1	24.1
1590008	ANR Pipeline - Alden Station	486210	95.9	914.7	3.0	3.0	0.2	34.9	21.2
1590015	Southern Star Central - Lyons Station	486210	9.7	77.0	1.2	1.2	0.0	3.9	1.9
1590052	Jacam Mfg. - Chemical Processing	325998	0.4	0.6	1.1	0.7	0.0	17.1	10.8
1590053	Jacam Mfg. - Organoclay Processing	327992	0.1	0.1	0.1	0.0	0.0	144.9	1.1
1610001	Fort Riley	928110	8.7	14.7	1.0	1.0	0.3	37.9	3.4
1610007	Kansas State University - Manhattan	611310	35.3	20.6	3.3	2.9	0.5	2.5	0.7
1650004	Messer LLC	325120	0.0	0.0	0.0	0.0	0.0	0.0	
1650016	Southern Star Central - Otis Station	486210	10.8	86.6	1.3	1.3	0.0	4.2	2.1

1650023	KBK Industries	326199						103.4	103.4
1690037	Crestwood Inc.	337110			2.1	2.1		74.5	43.1
1690050	SFC Global Supply Chain	311412	10.6	12.4	0.9	0.9	0.1	86.1	0.2
1690059	Salina Mun. Solid Waste Landfill	562212	0.0	0.1	0.0	0.0	0.0	8.1	5.4
1710025	Tallgrass Interstate - Scott City Station	486210	0.1	0.7	0.0	0.0	0.0	0.0	0.0
1730012	Evergy - Gordon Evans	221112	179.9	316.0	24.3	15.7	2.5	9.3	1.2
1730019	Textron Aviation - West Campus	336411	10.8	19.7	2.5	2.5	0.1	127.3	5.4
1730022	Textron Aviation - East Campus	336411	22.5	27.1	4.2	2.0	1.2	74.9	10.1
1730023	Evonik Corp. - Haysville	325110	21.2	20.8	17.8	1.4	0.1	52.0	1.8
1730029	Cargill - Wichita (soybean mill)	311224	32.0	38.1	59.1	46.7	0.2	412.8	356.3
1730045	Phillips 66 Carrier - Wichita North Products Breakout Terminal	424710	5.8	2.9	0.0		0.0	60.7	3.3
1730052	Bombardier Aerospace Learjet	336411	1.7	3.5	0.3	0.3	0.0	15.5	1.6
1730059	CNH Industrial - Wichita	333120	1.6	3.1	4.2	2.0	0.1	86.0	0.2
1730070	OxyChem - Wichita	325180	213.4	402.9	63.4	61.0	1.0	23.3	24.6
1730075	Textron Aviation - Pawnee Campus	336411	5.2	7.1	0.6	0.6	0.0	24.7	9.2
1730152	3P Processing	332813	1.4	2.1	0.5	0.2	0.0	29.3	13.5
1730155	Chance Rides Mfg.	333318			21.3			18.3	3.7
1730165	Globe Engineering	336413	0.3	0.3	0.0	0.0	0.0	7.8	7.8
1730173	R.D. Henry & Co.	337110	1.8	1.6	1.2	1.1	0.1	37.7	7.9
1730309	Spirit AeroSystems - Wichita	336411	87.3	108.5	192.4	165.9	0.9	638.2	326.9
1750001	Sunflower Electric - Cimarron River	221112	18.1	21.8	1.6	1.6	0.1	1.2	0.4
1750010	Merit Energy - East Woods Booster Station	486210	9.7	23.5	0.7	0.7	0.0	3.5	1.1
1750012	National Beef Packing - Liberal	311611	74.0	70.7	67.2	50.4	16.3	23.5	1.4
1750021	Panhandle Eastern Pipe Line - Liberal Station	486210	85.4	456.3	9.3	9.3	0.9	26.9	10.5
1750110	DCP Operating - National Helium Gas Plant	211130	13.1	12.8	1.1	0.8	3.1	144.2	2.7
1750114	Arkalon Ethanol	325193	27.9	61.7	36.2	25.0	47.9	34.9	7.3
1750116	WTG Hugoton - Sublette Station	486210	18.1	148.4	2.3	2.3	0.0	6.1	3.6

1770007	Goodyear Tire & Rubber	326211	33.7	109.8	43.1	3.1	0.2	206.1	15.9
1770018	Frito-Lay - Topeka	311919	68.6	57.0	36.7	8.9	4.0	11.2	3.7
1770035	Futamura USA	325220	28.1	16.8	2.6	2.6	479.2	561.9	357.2
1770180	Rolling Meadows Landfill & LFGTE	562212	209.0	111.5	30.5	30.5	15.3	38.4	2.6
1770233	HME Inc.	332312			43.8			45.5	11.2
1790011	Southern Star Central - Hoxie Station	486210	8.2	65.4	1.0	1.0	0.0	4.8	1.6
1810018	ADM Northern Sun - Goodland	311224	6.0	7.3	7.6	3.5	0.1	76.2	48.4
1850003	Southern Star Central - Stafford Station	486210	6.0	47.3	0.7	0.7	0.0	4.7	1.2
1890002	WTG Hugoton - Stevens Co. #4 Station	211130						4.1	0.0
1890008	WTG Hugoton - Hugoton Station	486210	801.4	730.9	8.2	8.2	0.2	30.2	14.2
1890014	Merit Energy - Breech Booster Station	486210	15.6	10.4	0.3	0.3	0.0	1.6	0.5
1890015	Merit Energy - Hugoton Station	486210	270.1	238.3	17.8	17.8	0.6	29.3	20.0
1890024	Scout Energy - Lateral C Station	211130	16.0	88.9	2.3	2.3		5.6	3.0
1890025	WTG Hugoton - Stevens Co. #2 Station	486210	17.4	97.2	1.5	1.5	0.0	6.5	2.4
1890032	WTG Hugoton - Stevens Co. #3 Station	486210						1.5	
1890044	Merit Energy - HUGS Satellite Booster D Station	486210	66.7	63.4	0.4	0.4	0.0	2.0	0.7
1890046	WTG Hugoton - Stevens Co. #6 Station	486210						1.4	0.0
1890050	Scout Energy - James Ford Station	211130	12.7	59.6	8.6	8.6	0.0	2.4	
1890051	Merit Energy - Hugoton #3 Station	486210	76.9	61.2	1.3	1.3	0.1	12.2	8.7
1910019	Wellington Mun. Power Plant #1	221112	0.1	0.1	0.0	0.0	0.0	0.0	
1910056	Wellington Mun. Power Plant #2	221112	0.4	1.9	0.1	0.1	0.0	0.0	
1950011	Southern Star Central - Ogallah Station	486210	19.6	159.6	2.4	2.4	0.0	8.4	3.9
2010001	Natural Gas Pipeline of America - Haddam Station 195	486210	80.0	133.0	1.7	1.7	0.8	26.4	
2010012	Sunflower Electric - Clifton	221112	7.5	24.7	0.6	0.6	0.0	0.2	0.1
2050037	Cobalt Boats - Neodesha	336612			1.5	0.0		189.3	144.3
2050045	River Rock Operating - Fireside Station	211130	7.4	26.6	1.7	1.7	0.1	9.2	2.2
2057039	Systech Environmental	562211	6.2	7.4	0.6	0.6	0.0	10.7	2.4

2090001	CertainTeed - Kansas City	327993	177.9	173.2	115.1	104.4	1.5	97.6	4.2
2090008	Kansas City BPU - Nearman	221112	281.6	1,228.1	162.3	121.9	1,023.2	19.0	7.0
2090009	Amsted Rail	331513	238.9	45.9	64.9	31.7	9.8	39.4	9.0
2090010	Owens Corning	327993	67.5	63.9	142.1	110.9	6.0	39.9	2.2
2090039	PQ Corp.	325180	14.3	17.1	1.5	1.3	0.1	11.7	2.5
2090046	General Motors - Kansas City	336111	17.4	21.5	68.4	2.3	0.2	380.6	14.8
2090048	Kansas City BPU - Quindaro	221112	12.0	106.4	2.4	2.4	8.4	1.8	0.8
2090060	Magellan Pipeline - Kansas City Products Breakout Terminal	424710	28.8	11.5				180.7	9.3
2090063	Sinclair Transportation - Kansas City Products Breakout Terminal	424710	6.1	2.5				79.2	0.8
2090075	Phillips 66 Pipeline - Kansas City Products Breakout Terminal	424710	10.3	5.3	0.0		0.1	75.6	2.0
2090194	Stericycle	562213	0.6	8.6	0.4	0.4	0.0	0.4	0.1
7770745	Cornejo & Sons - Wichita Air Curtain Combustor (portable)	562212	1.9	3.0	2.0		0.2	5.1	
7770776	Miles Excavating (air curt comb) (portable)	561730						0.0	
7770777	Kings Const. (air curt comb) (portable)	237310	0.1	0.1	0.1		0.0	0.1	
7770787	Midwest Concrete Materials (air curt comb) (portable)	212321	0.0	0.0			0.0	0.0	
7770809	Bob Bergkamp Const. (air curt comb) (portable) #2	562213	0.0	0.0			0.0	0.0	
7770843	Mies Const. (air curt comb) (portable)	562213	0.1	0.1	0.1		0.0	0.2	
7770846	Pearson Const. (air curt comb) (portable)	238910	0.3	0.4	0.3		0.0	0.7	
7770868	Kissick Const. (air curt comb) (portable)	237110	0.0	0.0			0.0	0.0	
7770873	ODonnell & Sons Const. (air curt comb) (portable)	238910	0.0	0.0			0.0	0.0	
7770877	George J Shaw Const. (air curt comb) (portable)	238910	0.0	0.0			0.0	0.0	
7770906	Sedgwick County Public Works (air curt comb) (portable)	924110	0.5	0.7	0.5		0.0	1.2	
7770914	ODonnell & Sons Const. (air curt comb) (portable)	238910	0.0	0.0			0.0	0.0	
7770932	Kansas Paving (air curt comb) (portable)	237310	0.0	0.1	0.0		0.0	0.1	

Title V (green) and PSD (red) permitted facility source locations.

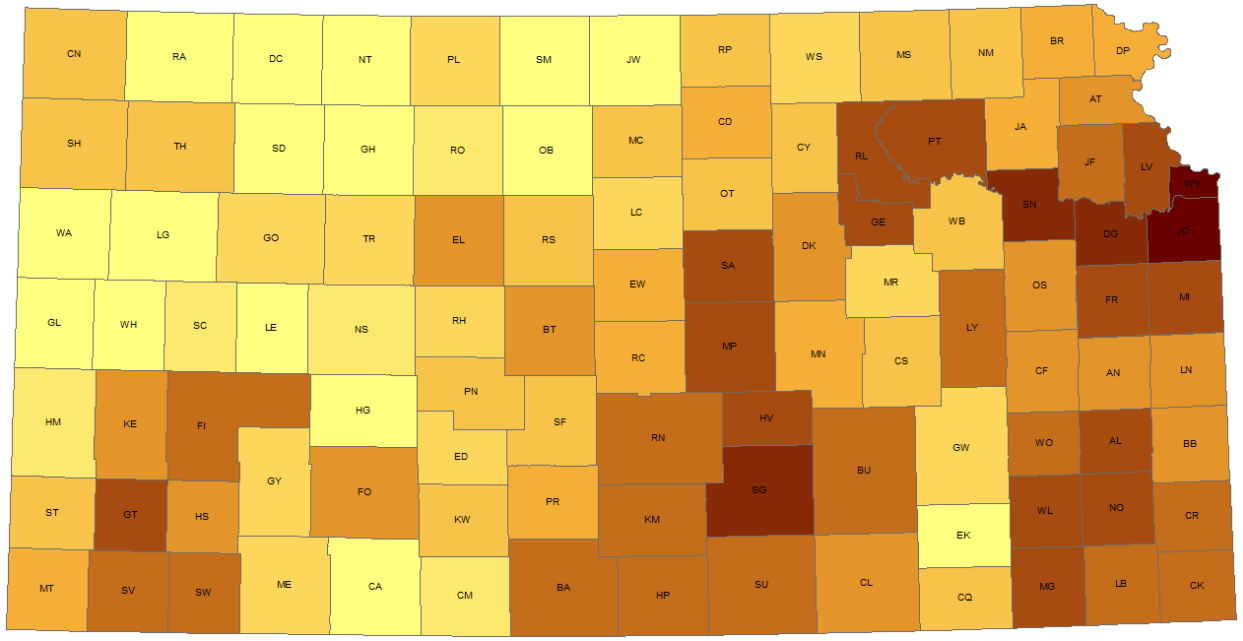


TitleV facilities PSD facilities

Source: Kansas Environmental Information Management System 2020

APPENDIX E

2016 Kansas Emissions Inventory — CO

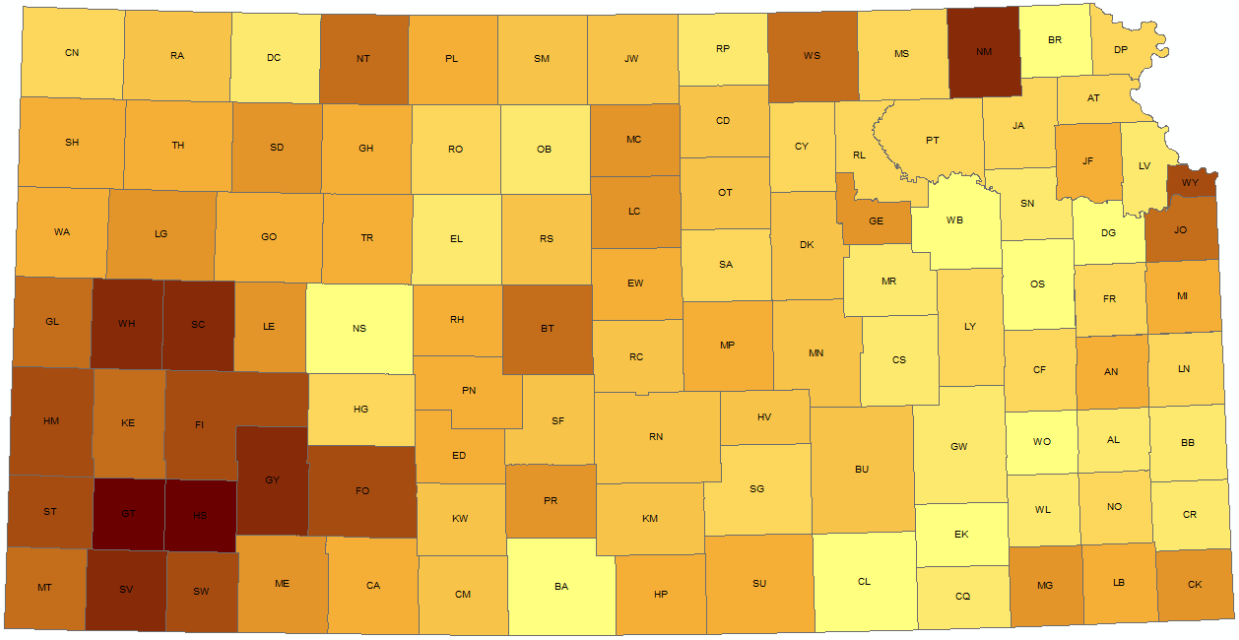


Anthropogenic CO Emissions

Density by county (tons per sq. mile)

0.6 - 1.3	4.5 - 6.4
1.4 - 1.7	6.5 - 9.5
1.8 - 2.3	9.6 - 18.8
2.4 - 3.2	18.9 - 64.7
3.3 - 4.4	64.8 - 156.8

2016 Kansas Emissions Inventory — NH_3

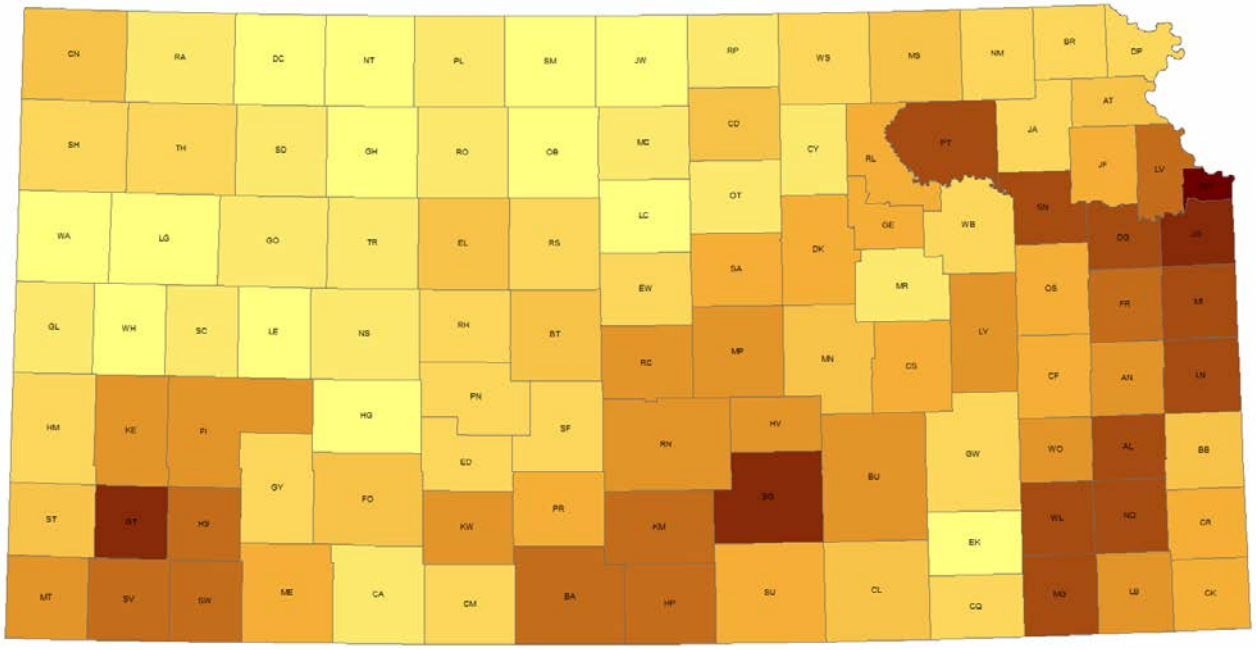


Anthropogenic NH3 Emissions

Density by county (tons per sq. mile)

	0.7 - 0.9		2.0 - 2.3
	1.0 - 1.2		2.4 - 3.0
	1.3 - 1.4		3.1 - 4.4
	1.5 - 1.6		4.5 - 7.5
	1.7 - 1.9		7.6 - 10.7

2016 Kansas Emissions Inventory — NO_x

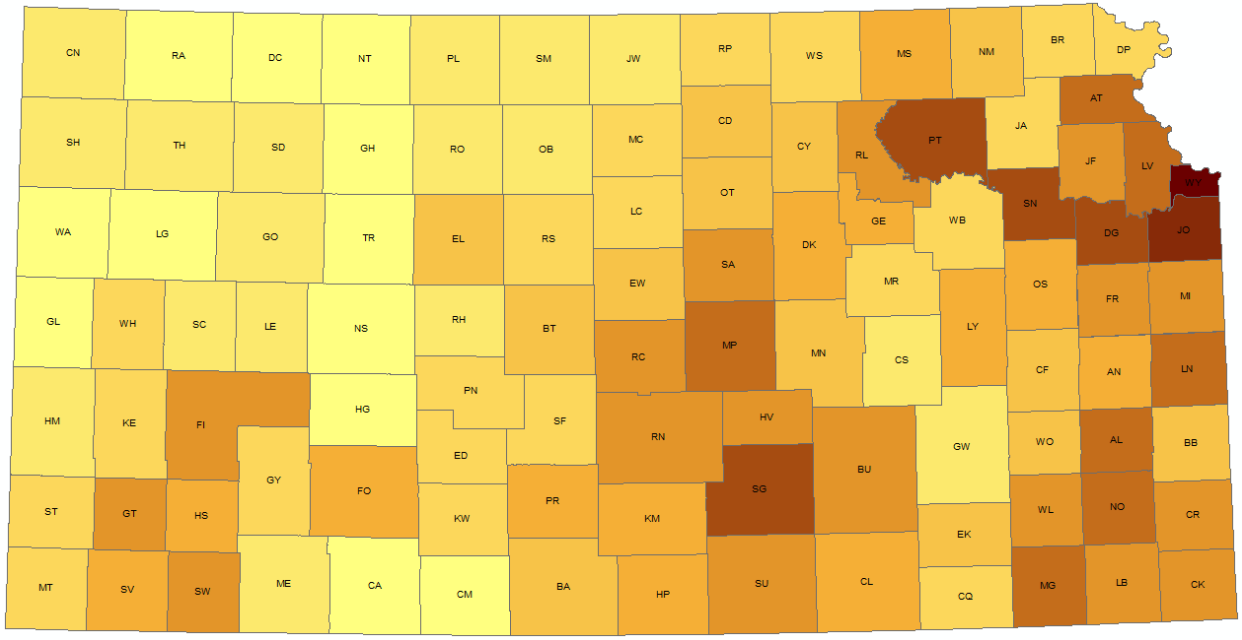


Anthropogenic NOx Emissions

Density by county (tons per sq. mile)

0.3 - 0.5	2.8 - 3.9
0.6 - 0.8	4.0 - 5.9
0.9 - 1.3	6.0 - 9.4
1.4 - 1.9	9.5 - 23.0
2.0 - 2.7	23.1 - 43.3

2016 Kansas Emissions Inventory — PM_{10}

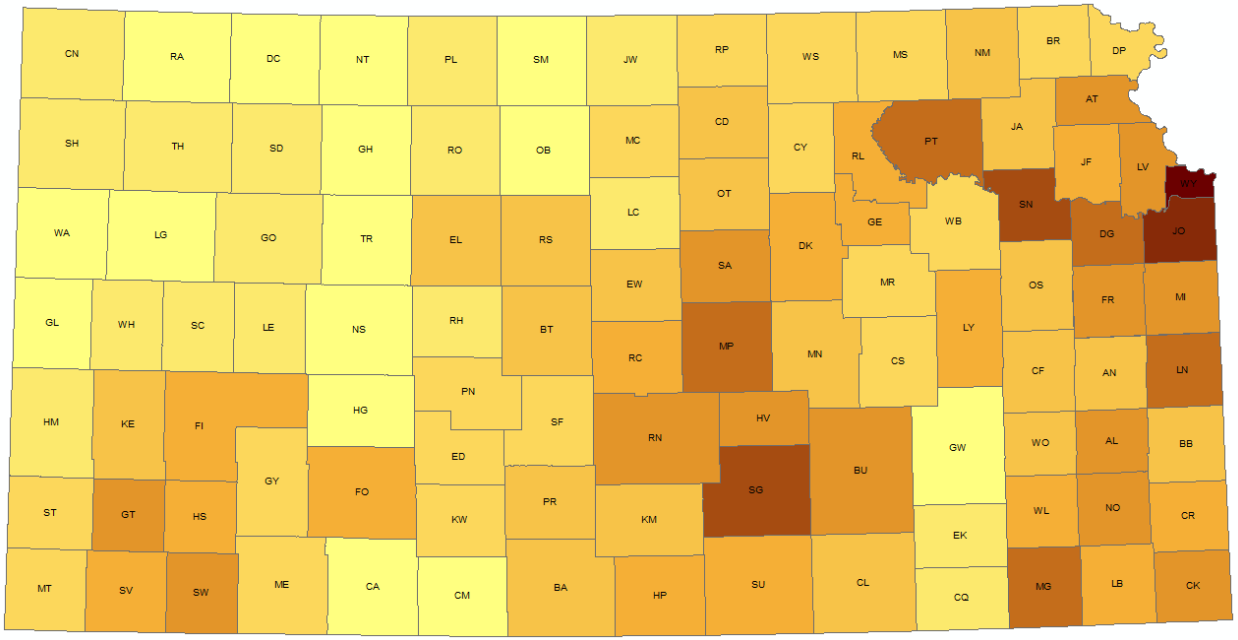


Anthropogenic PM10 Emissions (no nonpoint road or ag dust)

Density by county (tons per sq. mile)

0.0 - 0.06	0.5 - 0.6
0.07 - 0.1	0.7 - 1.1
0.11 - 0.17	1.2 - 2.0
0.18 - 0.2	2.1 - 3.5
0.3 - 0.4	3.6 - 6.7

2016 Kansas Emissions Inventory — $PM_{2.5}$

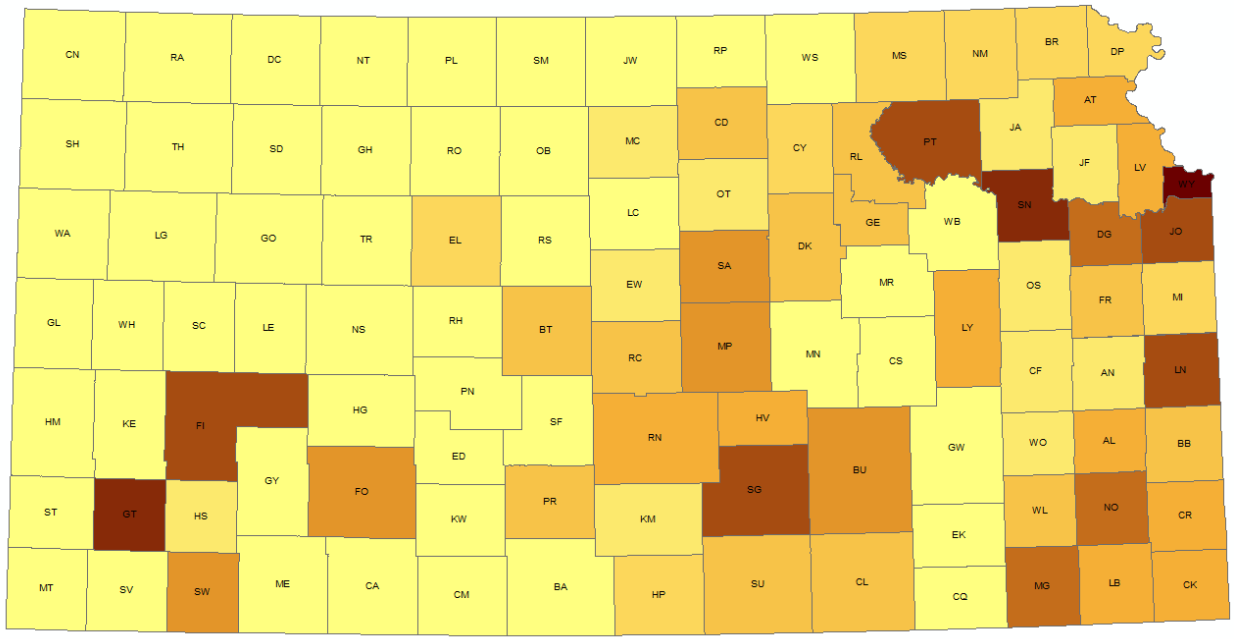


Anthropogenic PM25 Emissions (no nonpoint road or ag dust)

Density by county (tons per sq. mile)

- 0.0 - 0.05
- 0.06 - 0.09
- 0.1 - 0.13
- 0.14 - 0.22
- 0.23 - 0.33
- 0.34 - 0.6
- 0.7 - 1.0
- 1.1 - 1.6
- 1.7 - 2.6
- 2.7 - 5.2

2016 Kansas Emissions Inventory — SO_2

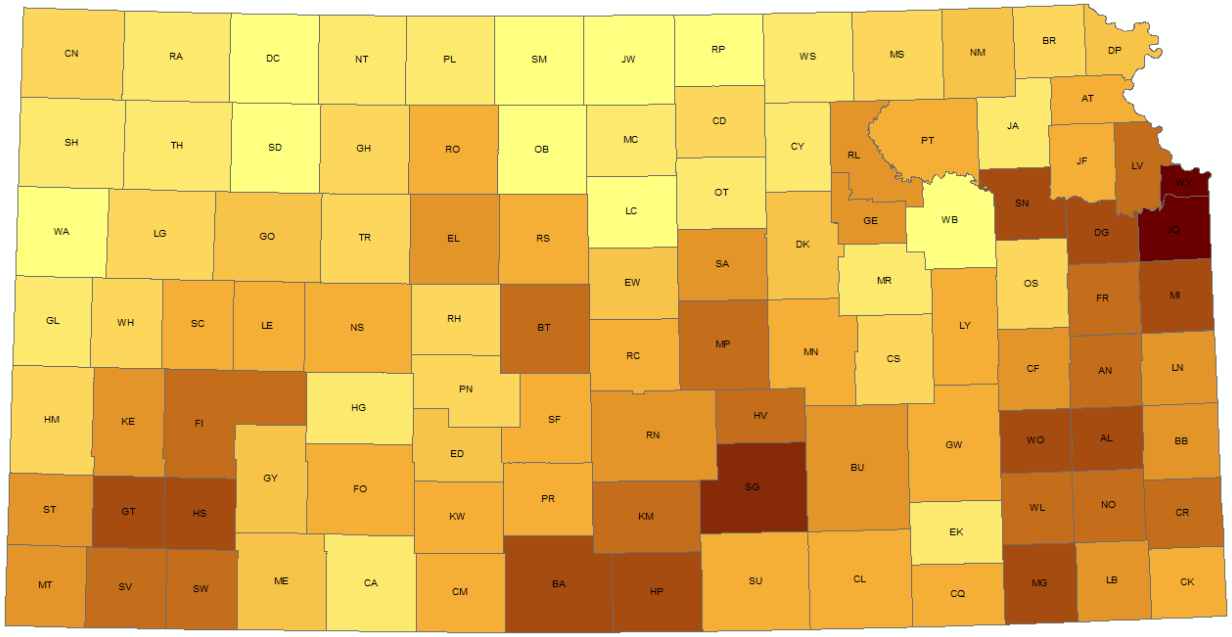


Anthropogenic SO2 Emissions

Density by county (tons per sq. mile)

0.001 - 0.009	0.12 - 0.19
0.010 - 0.019	0.20 - 0.87
0.02 - 0.29	0.88 - 1.72
0.03 - 0.59	1.73 - 3.47
0.06 - 0.11	3.48 - 17.58

2016 Kansas Emissions Inventory — VOC



Anthropogenic VOC Emissions

Density by county (tons per sq. mile)

- 0.35 - 0.55
- 0.56 - 0.77
- 0.78 - 0.97
- 0.98 - 1.30
- 1.31 - 2.14
- 2.15 - 3.43
- 3.44 - 5.27
- 5.28 - 9.55
- 9.56 - 15.83
- 15.84 - 41.75

APPENDIX F

PAMS Target Parameters

The data collected at the PAMS sites include measurements of O_3, NO_x, a target list of VOCs including several carbonyls, as well as surface and upper air meteorology. Most PAMS sites measure 56 target hydrocarbons on either a hourly or 3-hour basis during the O_3 season. The Type 2 sites also collect data on 3 carbonyl compounds (formaldehyde, acetaldehyde, and acetone) every three hours during the O_3 monitoring period. Included in the monitored VOC species are ten compounds classified as hazardous air pollutants (HAPs). All stations must measure O_3, NO_x, and surface meteorological parameters on an hourly basis. Below are the parameters monitored at the surface PAMS sites.[1]

Ozone, nitrogen oxides, VOC sums			**Surface Meteorological**	
Ozone	44201		Temperature	62101
			Wind Speed	61101/3
Nitric Acid	42601		Wind Direction	61102/4
Nitrogen Dioxide	42602		Relative Humidity	62201
Oxides of Nitrogen	42603		Solar Radiation	63301
			uv Radiation	63302/4
Total NMOC	43102		Barometric Pressure	64101
Sum of Targeted HCs	43000		Precipitation	65102
Hydrocarbons (HCs) - listed in elution sequence				
Ethylene	43203		2,3-dimethylpentane	43291
Acetylene	43206		3-methylhexane	43249
Ethane	43202		2,2,4-trimethylpentane	43250
Propylene	43205		n-Heptane	43232
Propane	43204		Methylcyclohexane	43261
Isobutane	43214		2,3,4-trimethylpentane	43252
1-Butene	43280		Toluene	45202
n-Butane	43212		2-methylheptane	43960
t-2-Butene	43216		3-methylheptane	43253
c-2-Butene	43217		n-Octane	43233
Isopentane	43221		Ethylbenzene	45203
1-Pentene	43224		m&p-Xylenes	45109
n-Pentane	43220		Styrene	45220
Isoprene	43243		o-Xylene	45204
t-2-pentene	43226		n-Nonane	43235
c-2-pentene	43227		Isopropylbenzene	45210
2,2-Dimethylbutane	43244		n-Propylbenzene	45209
Cyclopentane	43242		m-Ethyltoluene	45212
2,3-dimethylbutane	43284		p-Ethyltoluene	45213
2-methylpentane	43285		1,3,5-Trimethylbenzene	45207
3-Methylpentane	43230		o-Ethyltoluene	45211
2-Methyl-1-Pentene	43246		1,2,4-trimethylbenzene	45208
n-hexane	43231		n-Decane	43238

[1] https://www3.epa.gov/ttn/amtic/pamsmain.html

Methylcyclopentane	43262		1,2,3-trimethylbenzene	45225
2,4-dimethylpentane	43247		m-Diethylbenzene	45218
Benzene	45201		p-Diethylbenzene	45219
Cyclohexane	43248		n-Undecane	43954
2-methylhexane	43263			
Carbonyls				
Formaldehyde	43502			
Acetone	43551			
Acetaldehyde	43503			

APPENDIX G

Comments

No comments were received from the public on this document.