State of Kansas

5-Year Ambient Air Monitoring Network Assessment
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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), $PM_{2.5}$ speciation sites (trend and State), and CASNET (Clean Air Status and Trends Network). Specific site information includes location information (address and latitude/longitude), site type, objectives, spatial scale, sampling schedule, and equipment used. The assessment also describes the air monitoring objectives and how they have shifted recently with updates to National Ambient Air Quality Standards (NAAQS) and associated monitoring requirements.

Kansas Weather

Kansas experiences four distinct seasons because of the state's geographical location in the middle 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 2014, the average wind speed across the state was almost 12 miles per hour (m.p.h.). The predominant wind direction was from the south. The wind roses in Appendix A show wind speed and direction from meteorological sites in Goodland, 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 at a particular location, as well as the rate of dispersion of pollutants.

The ground-level ozone or smog problem develops in Kansas during the period from April 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 create health problems for citizens of Kansas.

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 or not network site monitors are in compliance with the 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 planning purposes such as State Implementation Plans (SIP's). The Health side of the agency uses ambient data to conduct health outcome analysis.

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), three 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

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

Kingman County
Sedgwick County
Sumner County

The Wichita MSA has seen a population increase of 1.61% from 2010 to 2014. In the Wichita MSA, KDHE/BOA has monitors in Sedgwick and Sumner Counties. The Manhattan MSA has seen a population increase of 5.2% from 2010 to 2014. The BOA currently has no monitoring stations in this MSA. The Topeka MSA has seen a population decrease of 0.05% from 2010 to 2014. The BOA has one monitoring site in Shawnee County. The Lawrence MSA has seen a population increase of 5.2% from 2010 to 2014. 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 3.08% from 2010 to 2014. In the Kansas City MSA, BOA has monitors in Leavenworth, Johnson and Wyandotte Counties. The U. S. Census Bureau 2000-2009 population change data of these MSAs is shown in Appendix B.

Combined Statistical Areas

The three CSAs in Kansas are Kansas City-Overland Park-Kansas City, MO-KS CSA, Manhattan-Junction City, 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

Manhattan-Junction City, KS CSA
Junction City, KS µSA
Manhattan, KS MSA

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

The Kansas City-Overland Park-Kansas City, MO-KS CSA has seen a population increase of 2.16% from 2010 to 2014. The KDHE/BOA operates four monitoring sites in this CSA. The Wichita-Arkansas City-Winfield, KS CSA has seen a population increase of 0.95% from 2010 to 2014. The BOA operates five monitoring sites in this CSA. The Manhattan-Junction City, KS CSA has seen a population increase of 6.6% from 2010 to 2014. The BOA does not operate any monitoring sites in this CSA. The U. S. Census Bureau 2010-2014 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

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 2010-2014 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 three 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. Table 1 below shows historic and recent criteria pollutant emissions (tons) in the EPA's NEI database from 2002-2011. In general, emissions in the on-road mobile sector continue to decrease as tougher fleet emission standards and fuel requirements are implemented. Point source emissions have also decreased for most pollutants during this time period with major decreases in NO_x and SO_2 emissions. Note that the methodology from period to period can change leading to large differences in reported values. For example, in 2002 the NH_3 inventory for Kansas included CAFO's as point sources, thus the NH_3 for point sources in this period was high while the nonpoint NH_3 values were lower for this period.

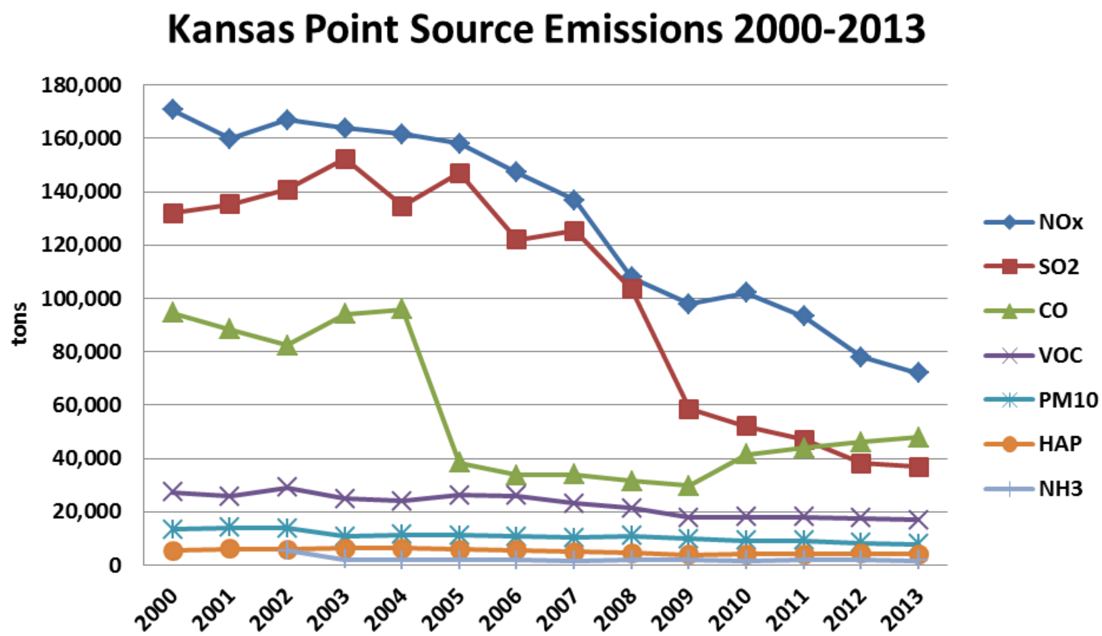
Table 1. Kansas Criteria Pollutant Emissions 2002-2011 (tons)

Year	Source Category	CO	NH_3	NO_x	PM_{10}	SO_2	VOC
2002	Area (nonpoint)	843,535	113,057	41,836	720,047	36,182	132,043
2005	Area (nonpoint)	897,771	168,761	49,411	754,205	39,384	181,981
2008	Area (nonpoint)	32,503	149,039	60,669	464,040	9,672	84,858
2011	Area (nonpoint)	267,622	172,257	106,338	785,422	3,013	179,510
2002	Nonroad mobile	268,920	35	82,129	7,994	7,050	24,229
2005	Nonroad mobile	220,441	45	86,691	5,986	8,081	24,702
2008	Nonroad mobile	178,997	37	42,010	3,930	816	19,669
2011	Nonroad mobile	155,397	39	37,647	3,434	88	17,326
2002	On-road mobile	679,737	2,869	85,585	2,200	2,893	47,251
2005	On-road mobile	538,060	3,021	68,176	1,915	1,824	43,898
2008	On-road mobile	548,564	2,968	62,450	1,665	490	46,136
2011	On-road mobile	273,125	1,135	62,255	2,978	313	24,312
2002	Point	81,234	52,681	165,586	17,038	140,619	27,187
2005	Point	38,253	1,813	157,984	11,166	146,997	26,106
2008	Point	31,495	1,936	107,911	10,928	103,417	21,468
2011	Point	43,802	1,949	95,994	10,244	46,891	18,283

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

Kansas conducts an annual point source inventory of permitted sources in the state. The inventory covers both permitted Title V facilities and those facilities that take a permit limit to avoid a Title V permit. Figure 1 below shows the trend in emissions from 2000 – 2013. As one can see from the graph, point source emissions have all trended down over the years except for CO. CO increases can be attributed to the installation of low-NOx burners on EGU's. KDHE expects this trend to continue for all pollutants, especially for SO_2, due to operation of scrubbers on electric generating units (EGU's), and NO_x, due to installation and operating of low NOx burners and selective catalytic reduction (SCR) at EGU's.

Figure 1 - Point Source Emissions Trends 2000-2013



Source - KDHE Air Emissions Inventory, Permitting, and Compliance 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 fairly 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 from 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 fairly 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 large drop in CO emissions that occurred in 2004 can be attributed to Columbian Chemicals, a carbon black plant, which significantly decreased their CO emissions by installing a flare. The slow rise in CO values since 2009 are attributed to the installation and operation of low-NOx burners on EGUs in the state. KDHE anticipates CO emissions will level off and remain fairly 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 VOC and NO_x react in the presence of sunlight. These ingredients come from motor vehicle exhaust, power plant and industrial emissions, gasoline vapors, chemical solvents, and from natural sources.

Nitrogen dioxide (NO_2) is a member of the nitrogen oxide (NO_x) family 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 EGU's, numerous gas compressor stations or those counties with a large population. Kansas has several large power plants that made up a significant portion of the total NO_x emissions in the state. Many of these power plants have or will be reducing their NOx emissions in the coming 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. The trend line for NO_x indicates a large reduction over the years (~99,000 tons since 2000) with a significant downward slope in the recent years. KDHE expects additional NO_x reductions as additional NO_x controls and/or fuel switching takes place on other power plants within the state.

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

Sulfur dioxide (SO_2), a member of the sulfur oxide (SO_x) family of gases, is formed from burning fuels containing sulfur (e.g., coal or oil) or from the oil 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 reflect the location of the coal fired power plants within the state. Coal fired EGU's and the states' refineries are the largest sources of SO_x emissions in Kansas. Similar to 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 agriculture in general. NH_3 is a precursor to secondary sulfate and nitrate particulate formation. KDHE anticipates NH_3 emissions will remain fairly consistent over the next few years and will continue to remain strongly associated with agricultural related activities.

Appendix F contains emissions density (tons/miles^2) plots on a county basis for Kansas. The emissions densities were calculated using the 2011 NEI emissions and include all anthropogenic emissions categories. Biogenic emissions are not included in these numbers. As one would expect, emissions are generally higher in heavily populated counties or in counties that have large emitting facilities such as power plants.

Appendix D contains the latest (2014) emission inventory for individual sources in the state and a map of all Title V and PSD permitted facility source locations in the state.

Ozone Monitoring Network

Current Ozone Standard and Monitoring Requirements

Current national ambient air quality standards (NAAQS) for Ozone (O_3) have been set to 0.075 parts per million (ppm) for both the primary standard and the secondary standard. EPA is proposing to strengthen the 8-hour ozone standard, designed to protect public health, to a level within the range of 0.065-0.070 parts per million (ppm) in the proposed rules published on December 17, 2014 (https://www.federalregister.gov/articles/2014/12/17/2014-28674/national-ambient-air-quality-standards-for-ozone). The proposed monitoring revisions would change monitoring requirements for the Photochemical Assessment Monitoring Stations (PAMS) network, revise the FRM for measuring O_3, revise the FEM testing requirements, and extend the length of the required ozone monitoring season in several states.

The new rule is expected to be finalized in October 2015; therefore the current network assessment for the upcoming 5 years must take the proposed rules into consideration. However, since the standard has not yet been announced or set, and the new monitoring requirements are not yet in effect, KDHE will take the proposals into consideration but will still rely upon the current monitoring standard and guidelines. Since monitoring data quality assurance reviews of the 2015 measurements have not yet been completed, monitoring data from 2010-2014 are used in this analysis.

State of Kansas Current Ozone Monitoring Network

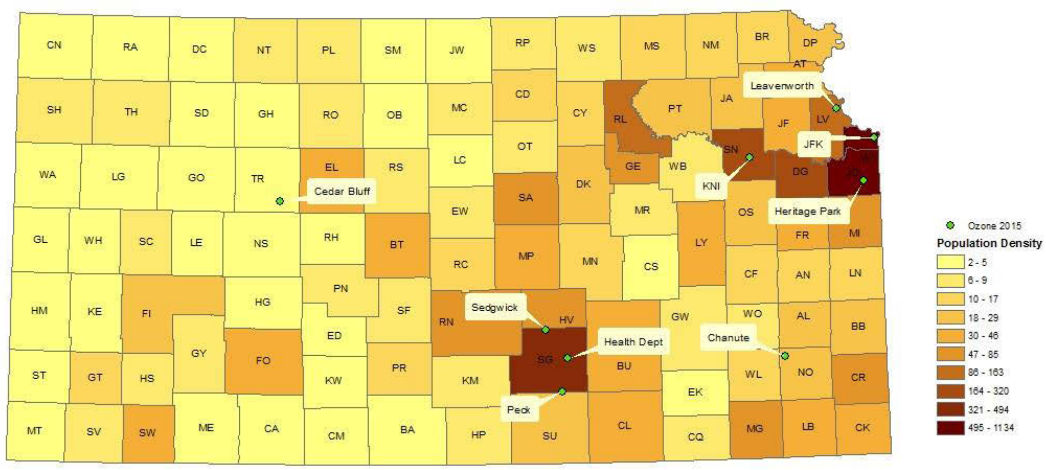
Current Kansas O_3 monitoring network includes 9 monitors located throughout the state. Monitors are listed in Table 2 along with detailed site information. No collocated O_3 measurements are available in Kansas.

Table 2. State of Kansas Ozone Monitor Site ID and Location

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

Figure 2 shows the population density of the State of Kansas along with the monitoring sites. Among these monitors, Wichita HD, Topeka KNI, Peck and Kansas City JFK NCore are urban scale monitors measuring population exposure; Sedgwick is an urban scale monitor measuring highest concentration; Heritage Park, Chanute and Leavenworth are neighborhood scale monitors measuring population exposure; Peck is a regional scale monitors measuring regional transport; and Cedar Bluff is regional scale monitor measuring the general background O_3 concentration in the state of Kansas.

Figure 2. Kansas Population Density Map with Ozone Monitor Locations



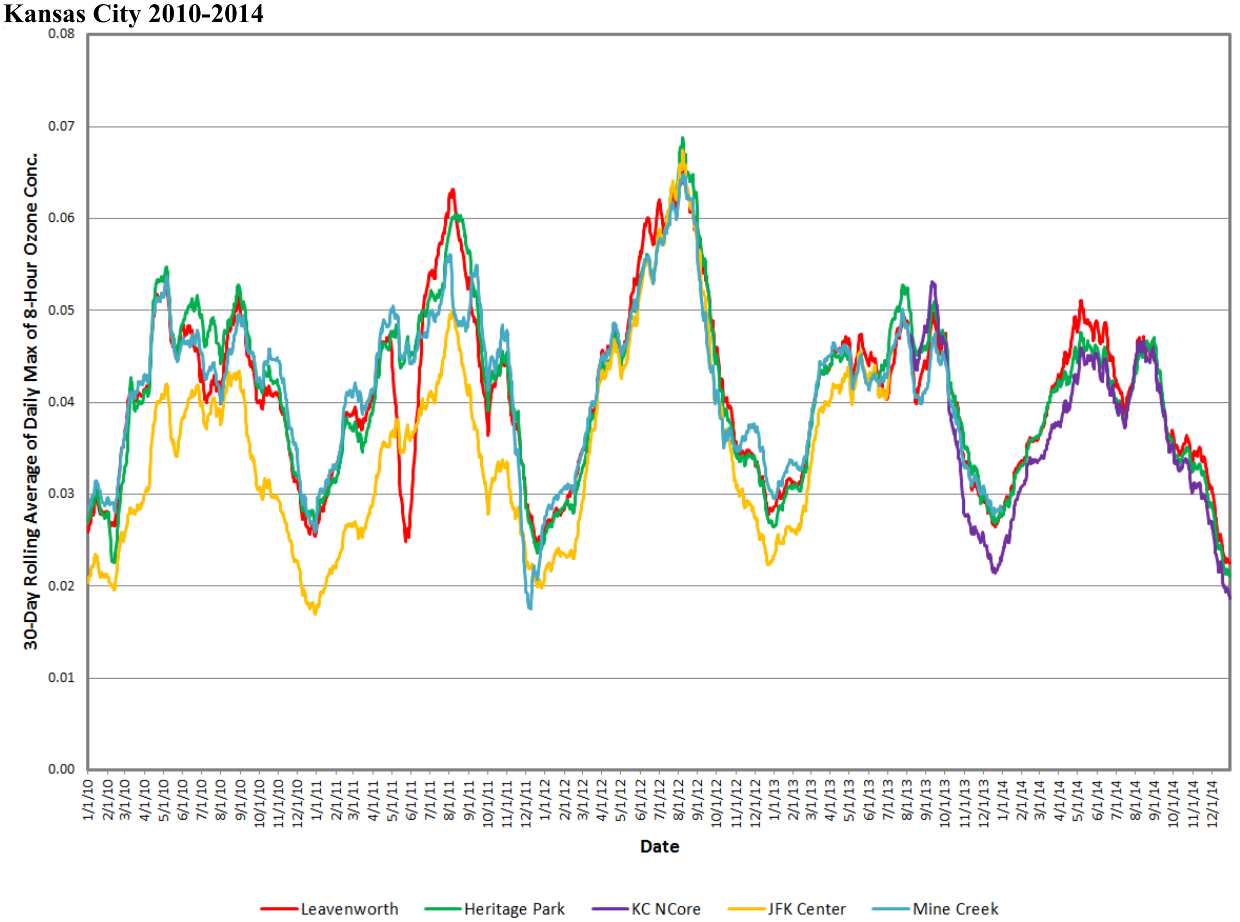
Ozone Measurements Trend Analysis

30-day rolling averages of the daily maximum 8-hour O_3 concentrations during 2010-2014 are presented in Figure 3 – Figure 5. Figure 3 included measurements from monitors within close proximity to Kansas City area.

In general, O_3 concentrations at 3 of the monitors show similar magnitude of concentration and track each other fairly well during the entire 5-year period. However, the concentrations recorded at the JFK site during 2010 and 2011 consistently were lower than the other monitors. This monitor then began recording similar concentrations to the other monitors in early 2012. This anomaly is being investigated by KDHE. High concentrations were observed in summer and low concentrations appear during the winter season as expected. Multiple spikes are observed during the ozone season (April 1 – October 31) each year; the spikes do not necessarily appear at the same time from year to year since summer ozone concentrations are also substantially affected by meteorological conditions (such as ambient temperature, cloud coverage, humidity and precipitation). However, each year the very first distinguishable peaks appear around April, with a high probability that significant contributions to these peeks are from the O_3 formed by the annual burning activities occurring in the Flint Hills area approximately 120 miles west of Kansas

City. The data does show that the measurements at Kansas City JFK site observed lower O_3 concentration in winter in comparison with the other measurements nearby possibly caused by the slower rate of O_3 production in winter due to reduced insolation and low temperatures, combined with O_3 consumption by NO_x in urban center (Kansas City JFK) where NO_x is readily available. For clarification purposes, JFK Center and KC NCore is the same monitoring site. KDHE renamed the site when it officially began operating as an NCore site.

Figure 3. 30-day Rolling Avg. of Daily Maximum 8-hr. Ozone Concentrations at Monitors near Kansas City 2010-2014

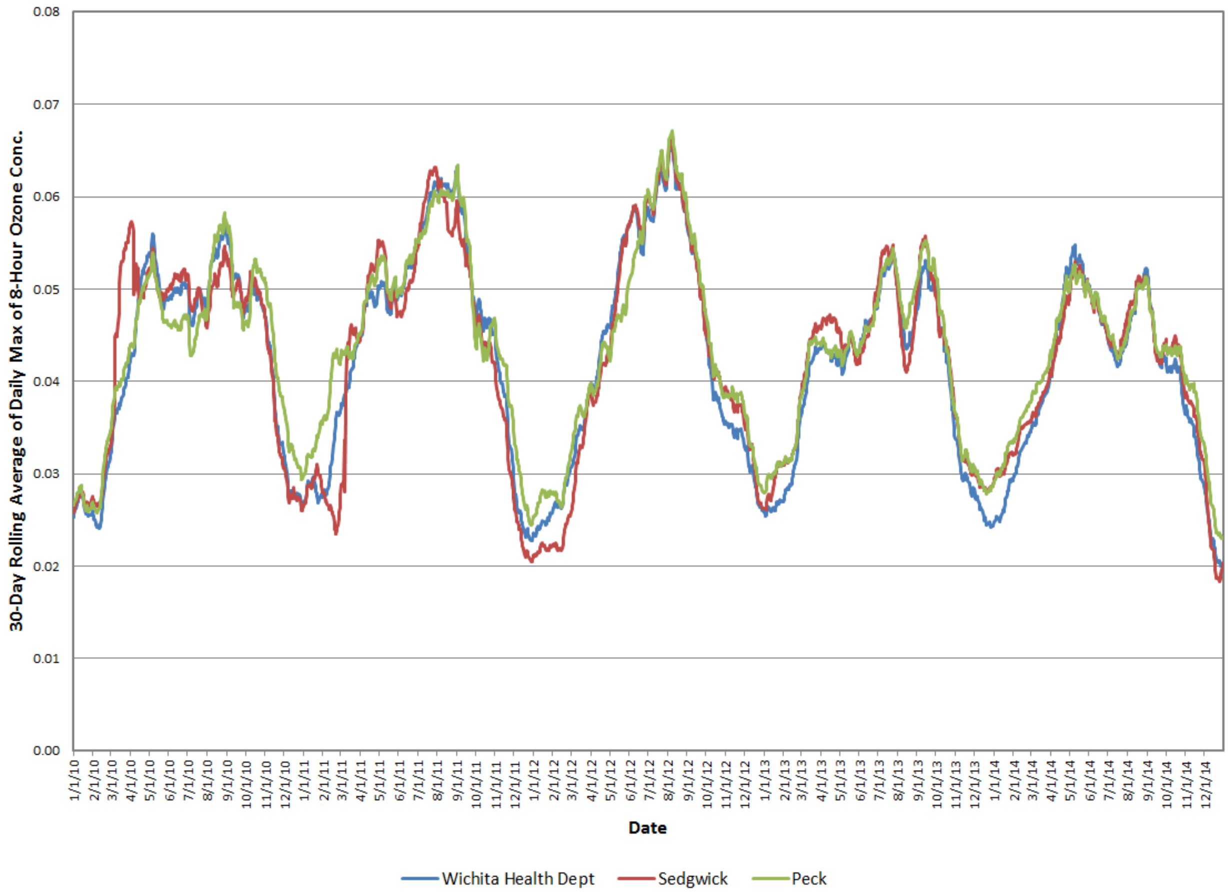


The 30-day rolling averages of the daily maximum 8-hour O_3 concentrations in or near Wichita are presented in Figure 4. Wichita Health Department is the urban center site located in downtown Wichita; Peck monitor is located to the south-southwest of the Wichita Health Department monitor, measuring regional O_3 transport into Wichita; and the Sedgwick monitor is located to the northwest of Wichita measuring O_3 concentration after the air parcel travels through the city.

Measurements from all three monitors show a consistent pattern: O_3 concentrations are high in summer and low in winter. In the past, the highest O_3 concentrations were measured at Peck as the air parcel coming into the city. Since the installation of the Sedgwick monitor, it had the highest design value for 2010-2012 and 2011-2013 time periods. All monitor's design values only vary by one or two ppb throughout the period.

There are discernable spikes starting around April each year. This likely indicates that the Flint Hills burning also affects the Wichita area. The April peaks in Wichita do not show the same pattern as those in Kansas City. This is because a different predominant wind direction determines the area which the burning affects. 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.

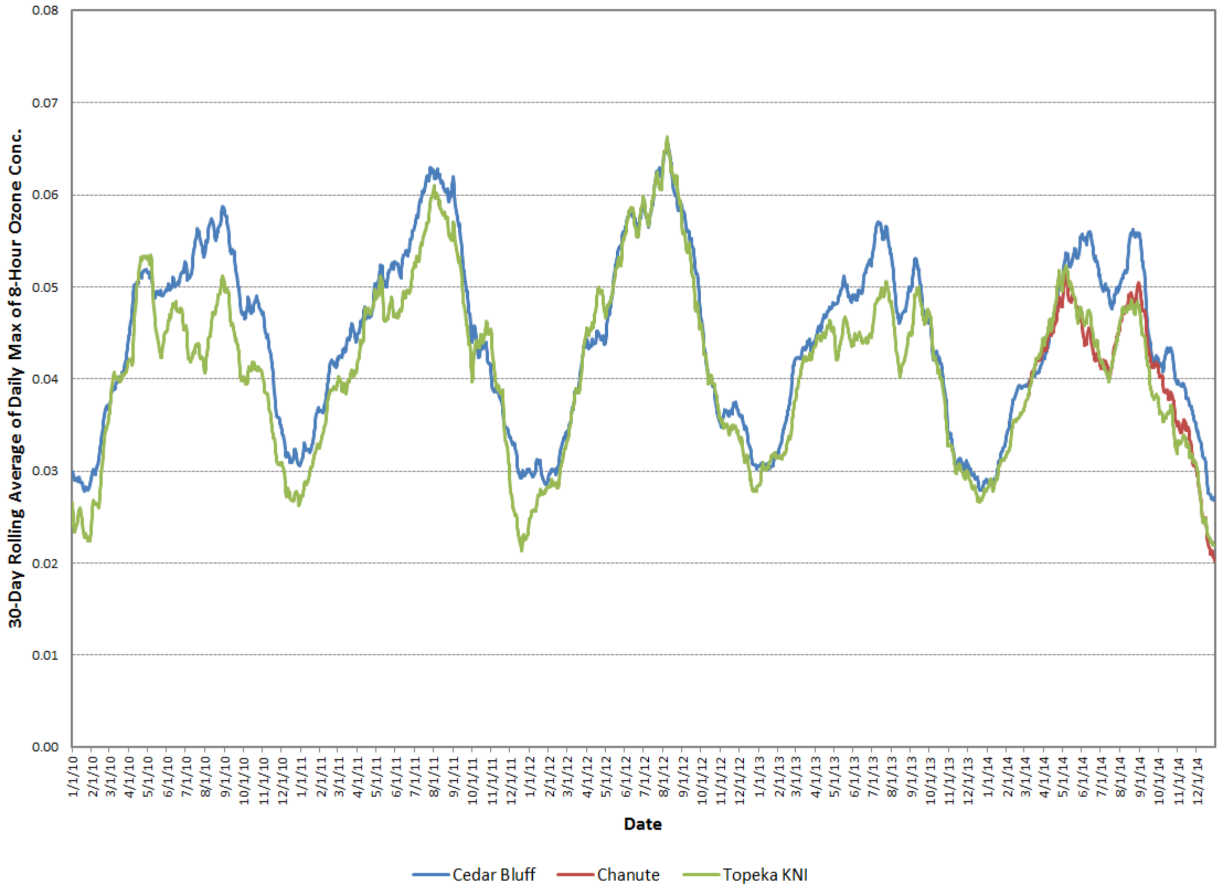
Figure 4. 30-day Rolling Avg. of Daily Maximum 8-hr. Ozone Concentrations at Monitors near Wichita 2010-2014



Measurements of the other three Kansas O_3 monitors are shown in Figure 5. Topeka/KNI site has been operated since late 2006; it continues to follow the trend of the other measurements. The Chanute monitoring site is new and began operations in 2014. In its limited time, it seems to be tracking well with the Topeka/KNI monitoring site.

In general, all 3 measurements show seasonal pattern with high O_3 concentrations observed in summer and low concentrations in winter. An interesting observation is that although Cedar Bluff is chosen as the background site due to the fact that it is not near any significant emission sources, the 30-day rolling averages of daily maximum 8-hour O3 concentrations at Cedar Bluff have been generally higher than both Topeka/KNI and Chanute. This indicates that the background O_3 concentration in Kansas is fairly high, and it is likely that the actual contributions from local emissions on average are a fairly small contribution to the existing conditions at many Kansas ozone monitors. KDHE also suspects that the extensive oil and gas fields of the Texas panhandle and western Oklahoma are contributing to the elevated readings at Cedar Bluff. Local emissions do play a role in the urban areas, especially in the Kansas City metro area on peak ozone days.

Figure 5. 30-day Rolling Avg. of Daily Maximum 8-hr. Ozone Concentrations at Topeka/KNI, Cedar Bluff and Chanute 2010-2014



The design values for each O_3 monitor during the last 5 years have been listed in Table 3. The values exceeding the current NAAQS for O_3 are listed in bold italic font. An upward, then downward trend in O_3 design values is observed at most sites. This is attributed to a very hot and dry 2012 ozone season that led to many exceedances across the country, including Kansas. During the past 5 years, all sites in Kansas have no more than 1 year with O_3 design value exceeding the NAAQS, except for Peck and Sedgwick, where 2 design values (consecutive years) exceed the standard. These data indicate none of the Kansas monitors show consistent exceedance of the current O_3 standard; rather it is the special conditions or episodes that pushed the O_3 concentration above the standard. It is important to note that meteorological conditions play a large part in producing ozone, thus a downward ozone trend does not necessarily indicate a reduction in the pre-cursor emissions that cause ozone. The downward trends could be a function of both favorable meteorological conditions and reductions in emissions.

Table 3. Ozone Design Values for all Kansas Monitors during the Past 5 Years

Site Name	08-10 Average	09-11 Average	10-12 Average	11-13 Average	12-14 Average
Heritage Park	0.065	0.069	***0.076***	0.073	0.070
Leavenworth	0.065	0.069	0.074	0.073	0.071
Mine Creek	0.064	0.067	0.072	0.071	0.070(term.)
Park City	0.065	terminated	terminated	terminated	terminated
Wichita Health Dept.	0.071	0.074	***0.077***	0.075	0.073
Topeka KNI	0.065	0.068	0.074	0.073	0.069
Peck	0.072	0.075	***0.077***	***0.076***	0.073
Cedar Bluff	0.067	0.071	0.074	0.072	0.069
Kansas City JFK	0.061	0.060	0.067	0.070	0.070
Chanute					0.062**
Sedgwick		0.073	***0.077***	***0.077***	0.072

**-Not a three-year average, began in early 2014

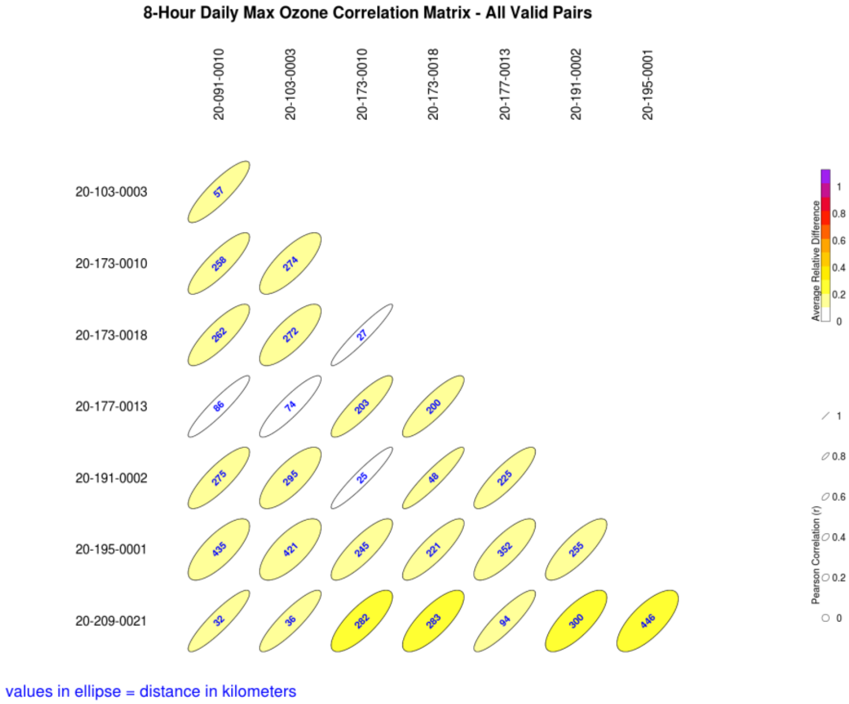
Correlations between Kansas Ozone Monitors

Figure 6 presents the correlation matrix produced from the LADCO NetAssess analysis tool (http://ladco.github.io/NetAssessApp/index.html) for January 1, 2011 through December 31, 2013 O_3 measurements. The Correlation Matrix tool generates a graphical display that summarizes the correlation, relative difference and distance between pairs of monitoring sites. Within the graphical display, the shape of the ellipses represents the Pearson correlation between sites. Circles represent zero correlation and straight diagonal lines represent a perfect correlation. 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 meteorology. The correlation, however, may indicate whether a pair of sites is related, but it does not indicate if one site consistently measures pollutant concentrations at levels substantially higher or lower than the other. For this purpose, the color of the ellipses represents the average relative difference between sites where the daily relative difference is defined as:

$$\frac{abs(s1 - s2)}{avg(s1, s2)}$$

Where s1 and s2 represent the ozone concentrations at sites one and two in the pairing, abs is the absolute difference between the two sites and avg is the average of the two site concentrations. The average relative difference between the two sites is an indicator of the overall measurement similarity between the two sites. Site pairs with a lower average relative difference are more similar to each other than pairs with a larger difference. Both the correlation and the relative difference between sites are influenced by the distance by which site pairs are separated. Usually, sites with a larger distance between them will generally be more poorly correlated and have large differences in the corresponding pollutant concentrations. The distance between site pairs in the correlation matrix graphic is displayed in kilometers in the middles of each ellipse.

Figure 6. Correlation Matrix for 2011-13 Ozone Measurements in Kansas



In general, good correlations were observed for the Kansas City monitoring sites. Among the three monitoring sites near Kansas City, JFK (20-209-0021) shows very high correlation and low relative difference compared to the other 2 sites. Therefore measurements at JFK are good representations of the entire Kansas City region on the Kansas side. The correlations between Heritage Park (20-091-0010) and Leavenworth (20-103-0003) are only slightly different, assumed to be attributed to Leavenworth being on the north side of the metro area and more likely to receive higher emissions from the predominant southerly wind direction during ozone season.

Topeka/KNI (20-177-0013) is an urban site not too far away (50 miles west) from the Kansas City urban center sites; this site generally tracks very well with the three Kansas City sites (high correlation and low relative difference).

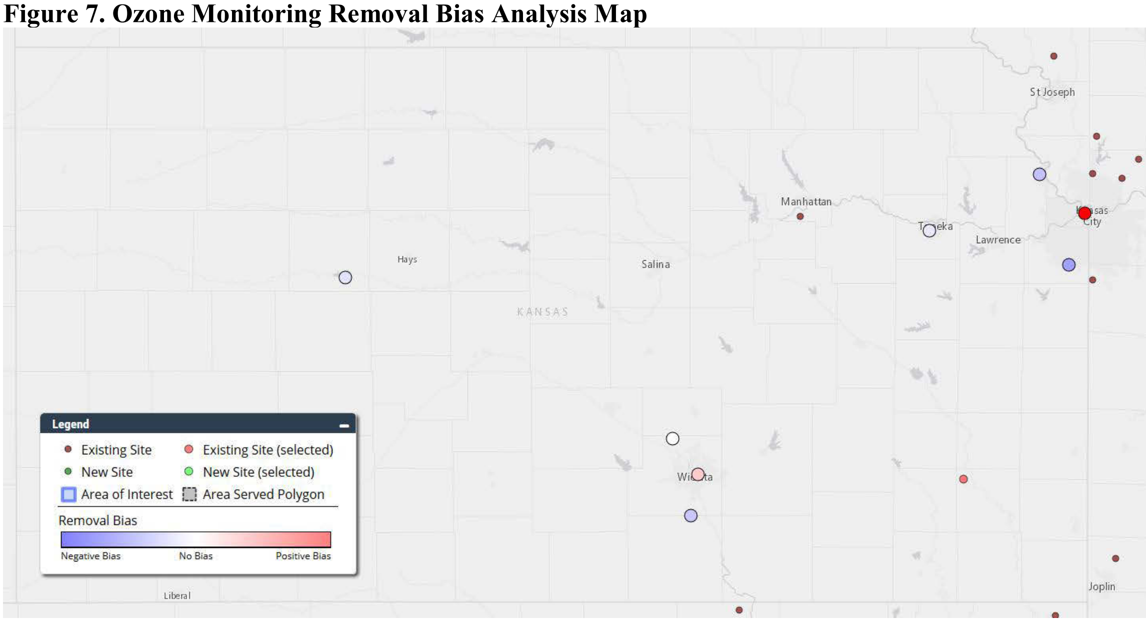
The Chanute monitor (20-133-0003) was not included in this evaluation as it only began operations in early 2014.

All three Wichita sites (WHD: 20-173-0010; Sedgwick: 20-173-0018; Peck: 20-173-0002) also show extremely high correlation among each other. These three sites are located within 30 miles of each other. The correlations between Wichita sites and Kansas City sites are generally not as good since the monitoring sites are quite far away and are influenced by different factors most of the time.

Ozone 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. So, those sites with large positive bias are more likely candidates to be removed or relocated because they are not measuring the peak ozone in the area. Figure 7 shows the results of this removal bias tool run for the Kansas monitors (excluding Chanute). Red circles indicate positive bias while blue indicate negative bias. JFK has a high positive removal bias which indicates the removal of this site would make the average of the remaining sites increase. JFK is an NCore monitoring site and was located in this area as an urban core site monitoring for population exposure. It appears that the JFK monitor is experiencing NOx titration and thus ozone is being depressed at this monitor from the local NOx emissions from the urban core.

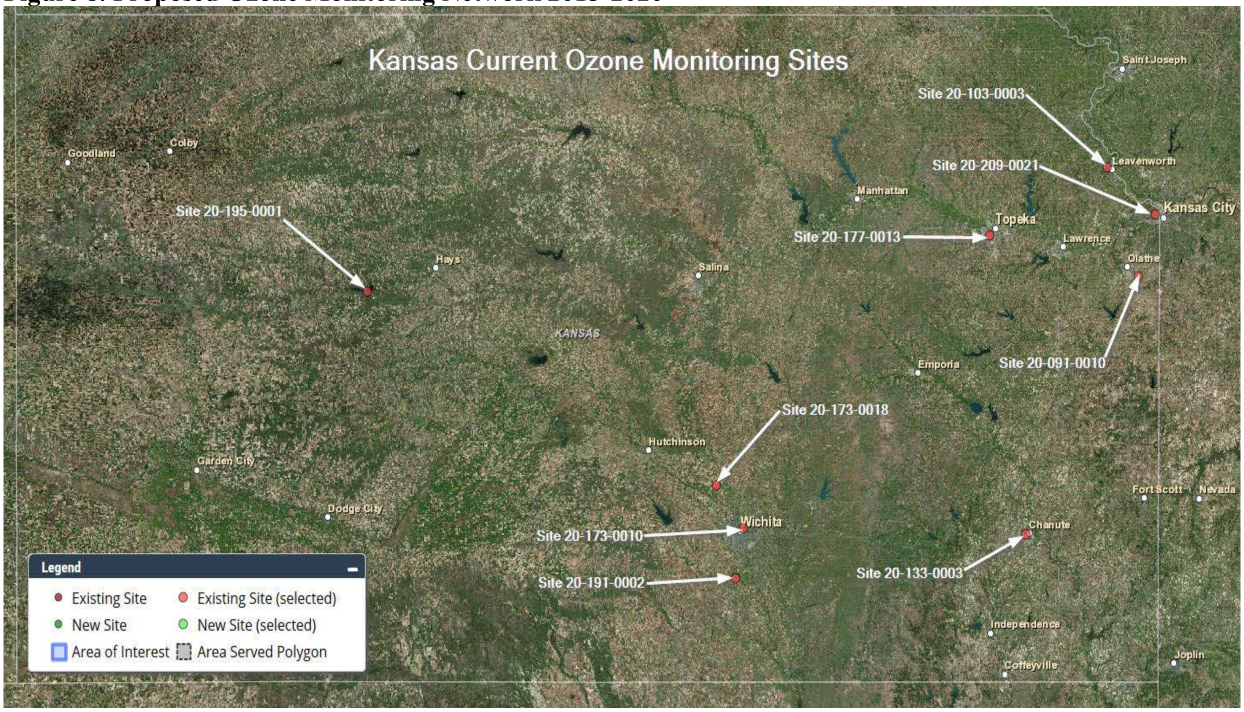
Figure 7. Ozone Monitoring Removal Bias Analysis Map



Proposed Kansas Ozone Monitoring Network 2015-2020

After a careful review of all the above factors, the proposed Kansas O_3 monitoring network for the upcoming 5 years is presented in Figure 8. This proposal does not reflect any potential proposed changes associated with the ozone standard due to be released in October of 2015. Overall, KDHE proposes maintaining its current network configuration and will adjust the network if required as part of the new ozone standard.

Figure 8. Proposed Ozone Monitoring Network 2015-2020



$PM_{2.5}$ 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 annual average and 35 micrograms per meter cubed 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 4.

Table 4. $PM_{2.5}$ 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 the minimum monitoring requirements to Kansas urban areas, population totals and historical $PM_{2.5}$ measurements results in the design requirements are shown in Table 5.

According to Tables 4 and 5, $PM_{2.5}$ 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 5. Minimum Number of $PM_{2.5}$ Monitors Required in Kansas MSAs

MSA	Population (2014)	Number of Existing $PM_{2.5}$ Monitors	$PM_{2.5}$ Monitors Required
Wichita, KS	641,076	4	1
Topeka, KS	233,758	1	0
Lawrence, KS	116,585	0	0
St. Joseph, MO-KS	127,431	0	0
Manhattan, KS	98,091	0	0
Kansas City, MO-KS	2,071,133	3 (KS side only)	2

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

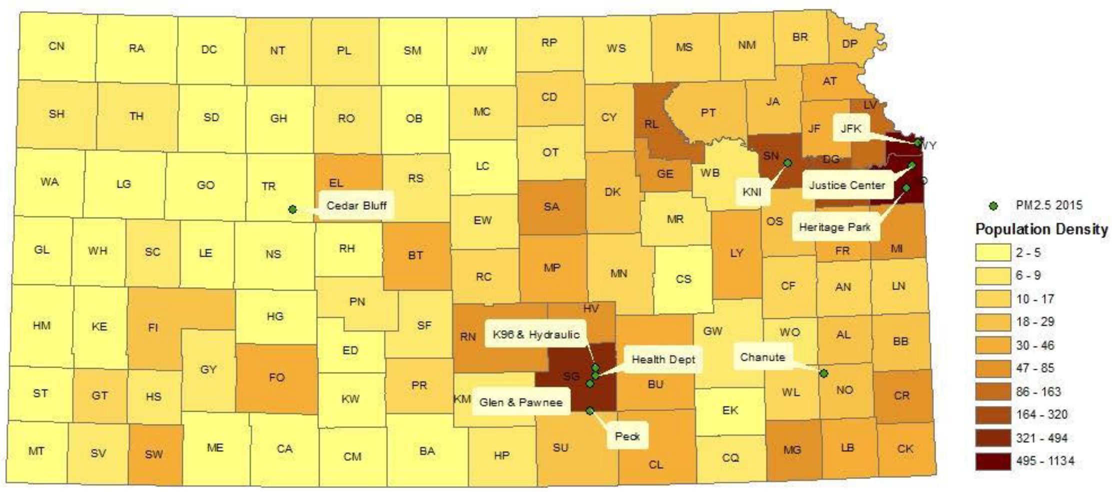
Current Kansas $PM_{2.5}$ monitoring network includes 11 monitors located throughout the state at 10 different monitoring sites. Nine of the monitors are filter based while the remaining two monitors are continuous Tapered Element Oscillating Microbalance (TEOM). Both TEOMs are Thermo Scientific 1405-DF TEOM Continuous Dichotomous Ambient Air Monitors and are considered a federal equivalent monitors. Monitor locations and type are listed in Table 6 along with detailed site information. Two sites have collocated filterable $PM_{2.5}$ measurements, one at JFK in Kansas City and one at the Wichita Health Department. In addition, the JFK site also has a continuous $PM_{2.5}$ monitor.

Table 6. State of Kansas $PM_{2.5}$ Monitor Site ID and Location

Site Name	Site ID	City	Address	Lat_DD	Lon_DD	$PM_{2.5}$ (filter)	$CPM_{2.5}$
Cedar Bluff	195 - 0001	Cedar Bluff	Cedar Bluff Reservoir, Pronghorn & Muley	38.77028	-99.7636	NO	YES
Justice Center	091 - 0007	Overland Park	85th And Antioch	38.97444	-94.6869	YES	NO
Heritage Park	091 - 0010	Olathe	13899 W 159th (Heritage Park)	38.83859	-94.7464	YES	NO
Glenn & Pawnee	173 - 0009	Wichita	Fire Sta#12 Glenn & Pawnee	37.65111	-97.3622	YES	NO
Health Dept.	173 - 0010	Wichita	Health Dept., 1900 East 9th St.	37.70111	-97.3139	YES	NO
KNI	177 - 0013	Topeka	2501 Randolph Avenue	39.02427	-95.7113	YES	NO
Peck	191 - 0002	Peck	707 E 119th St South, Peck Community Bldg.	37.47694	-97.3664	YES	NO
K-96 & Hydraulic	173 - 1012	Wichita	K-96 & Hydraulic	37.74722	-97.3163	YES	NO
Chanute	133 - 0003	Chanute	1500 West Seventh, Chanute, KS	37.67696	-95.4759	YES	NO
JFK	209 - 0021	Kansas City	1210 N. 10th St., JFK Recreation Center	39.1175	-94.6356	YES	YES

Figure 9 shows the population density (2010 Census) of the State of Kansas along with the $PM_{2.5}$ monitoring sites. All of these monitors have 3 year design values below the 85% of the NAAQS concentration category.

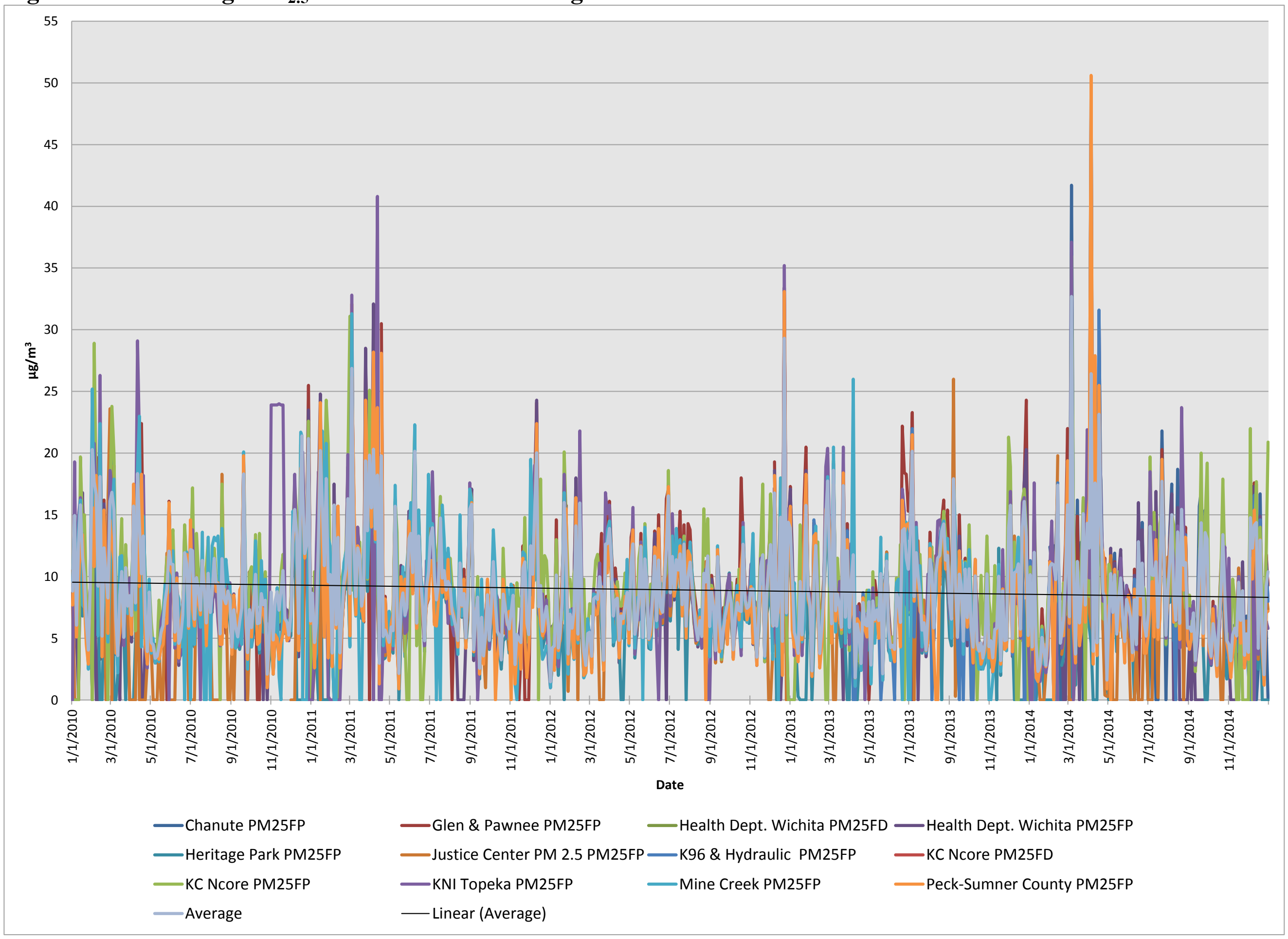
Figure 9. Kansas Population Density Map and $PM_{2.5}$ Monitor Locations



$PM_{2.5}$ Measurements Trend Analysis

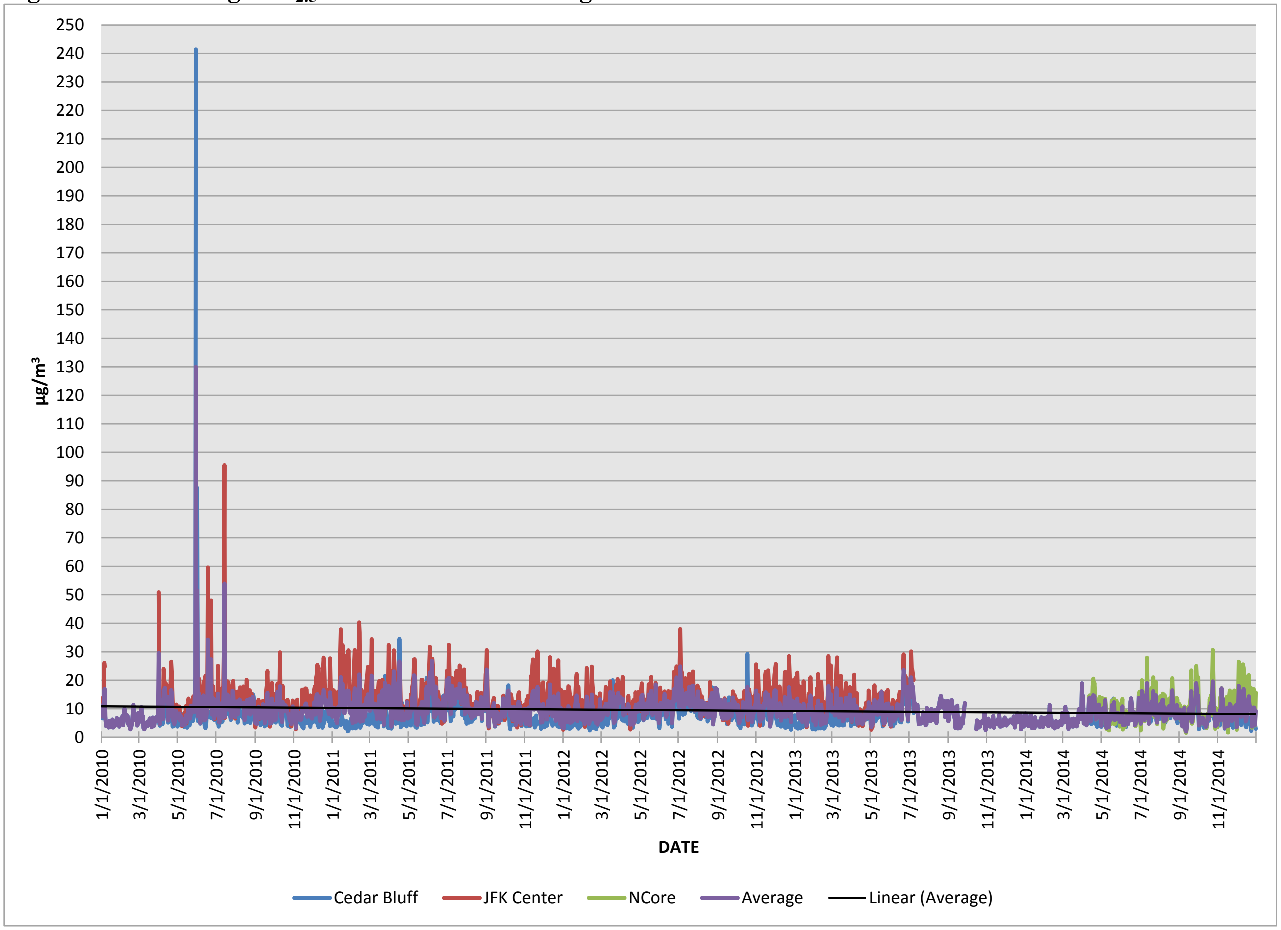
Both the continuous TEOM and filter based $PM_{2.5}$ measurements were evaluated for trend analysis. Figure 10 displays the 24 hour data for the one-in-three monitoring for the ten filter based monitors. Eight of these are primary monitors, with two collocated monitors located at JFK NCore and the Wichita Health Department. It is important to note that the Mine Creek site was replaced by the Chanute site in 2014. For the filter based monitoring the average trend across all monitors is slightly downward.

Figure 10. 24-hr Avg. $PM_{2.5}$ Filter Based Monitoring Data w/ Trendline 2010-2014



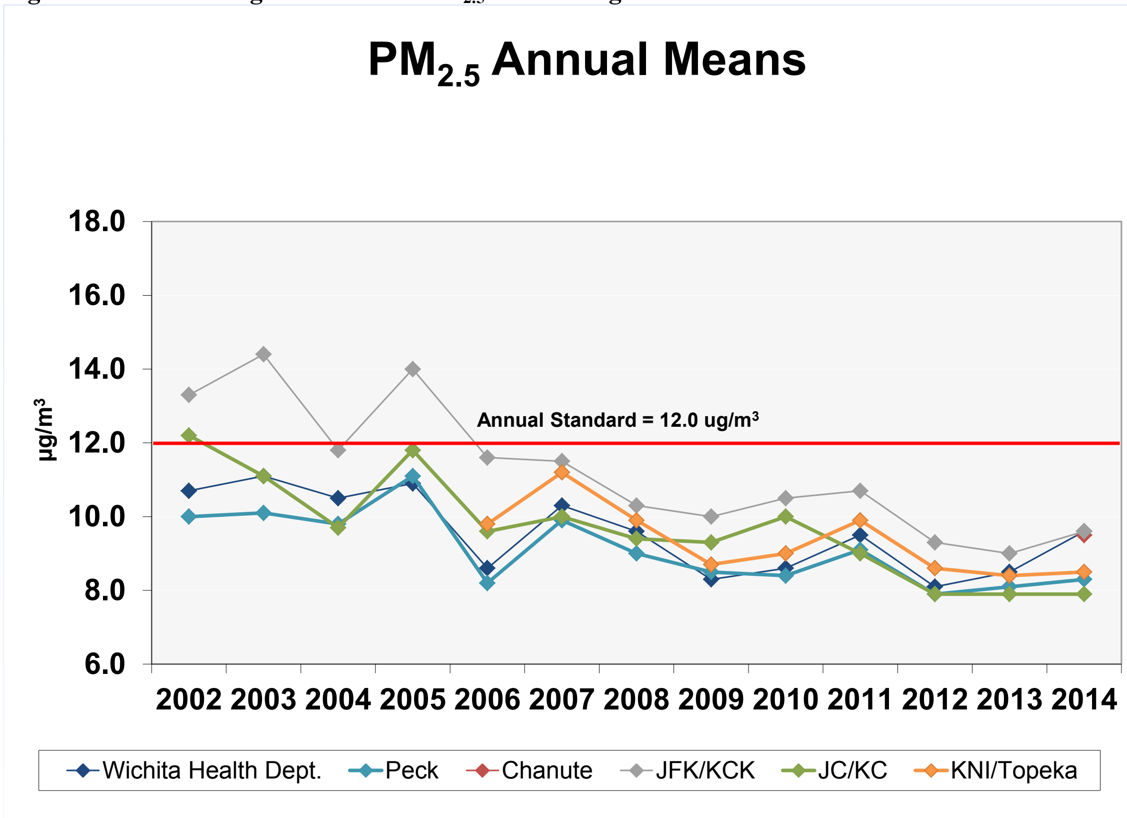
For the continuous data the trend over the 5-year period, 2010-2014, has also been slightly downward. Figure 11 shows the 24-hour average of the two continuous monitors along with the linear trendline. JFK Center and NCore are the same site location but a 1405DF instrument replaced the existing continuous monitor in 2013. These two continuous monitors are located in opposite ends of the state and one (JFK/NCore) is located in an urban area while the other (Cedar Bluff) is located in a rural area of western Kansas. The JFK/NCore monitor is located in the Kansas City urban area and raises the overall average because it has slightly higher readings on average than the other monitor. Overall, the average continuous and filterable $PM_{2.5}$ readings across the state are below the NAAQS standard.

Figure 11. 24-hr Avg. $PM_{2.5}$ Continuous Monitoring Data w/ Trendline 2010-2014



Very similar trends are seen when looking at the annual averages. Figure 12 provides the annual average filter based $PM_{2.5}$ readings from 2002 – 2014. As is seen in the 24-hr case, the trend is slightly downward.

Figure 12. Annual Avg. Filter Based $PM_{2.5}$ Monitoring Data 2002-2014



The design values for each $PM_{2.5}$ monitor have been listed in Tables 8 and 9. 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. The TEOM monitors are listed in Italic in Tables 7 and 8 below.

Table 7. 24-hr $PM_{2.5}$ Design Values (98th percentile) - Kansas Monitors (µg/m^3)

Site Name	12-14 Average
Heritage Park	16
Cedar Bluff (TEOM,1405-DF)	*15*
Wichita Health Dept.	22
Pawnee & Glenn	23
K96 & Hydraulic	24
Topeka KNI	20
Peck	21
Kansas City JFK/NCore (TEOM-FDMS,1405-DF)	*26*
Kansas City JFK	20
Justice Center	17

Table 8. Annual $PM_{2.5}$ Design Values for all Kansas Monitors ($\mu g/m^3$)

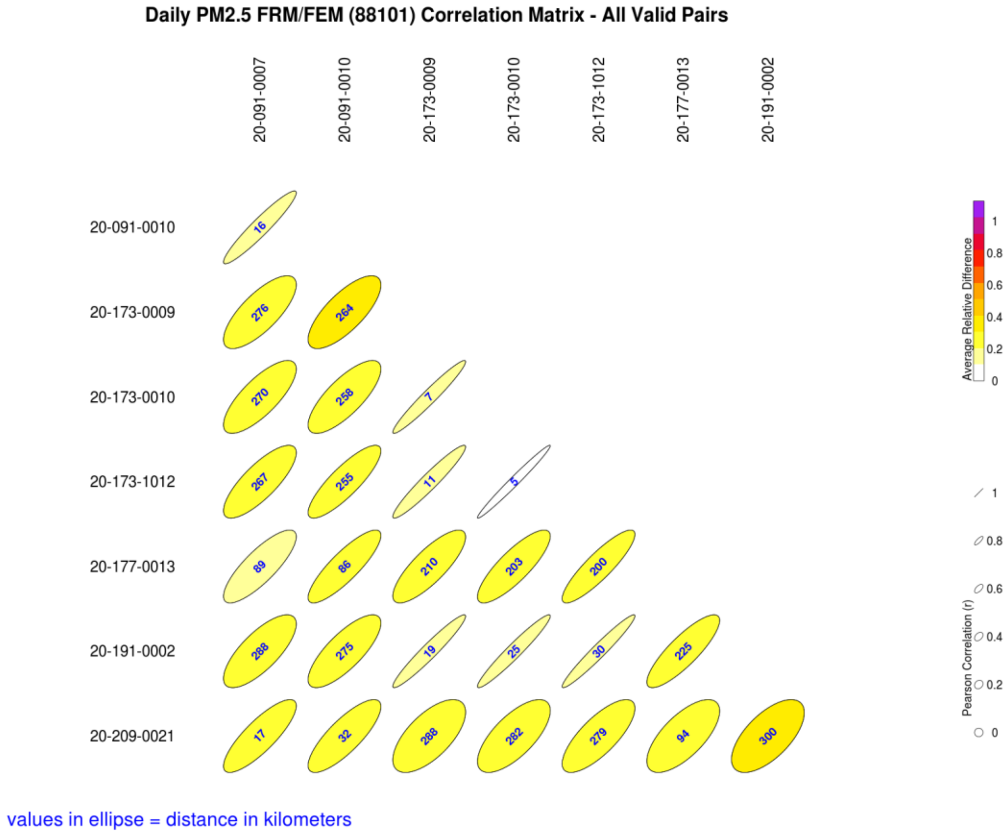
Site Name	12-14 Average
Heritage Park	7.2
Cedar Bluff (TEOM,1405-DF)	*7.1*
Wichita Health Dept.	8.7
Pawnee & Glenn	9.4
Topeka KNI	8.5
Peck	8.1
Kansas City JFK/NCore (TEOM-FDMS,1405-DF)	**
Kansas City JFK	9.3
Justice Center	7.9
K96 & Hydraulic	8.9

**- Data Not Available for Calculation

Correlations between Kansas $PM_{2.5}$ Monitors

Figure 13 presents the correlation matrix produced from the LADCO NetAssess analysis tool (http://ladco.github.io/NetAssessApp/index.html) for January 1, 2011 through December 31, 2013 $PM_{2.5}$ measurements. The Correlation Matrix tool generates a graphical display that summarizes the correlation, relative difference and distance between pairs of monitoring sites. Within the graphical display, the shape of the ellipses represents the Pearson correlation between sites. Circles represent zero correlation and straight diagonal lines represent a perfect correlation. 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 meteorology.

Figure 13. Correlation Matrix for 2011-13 $PM_{2.5}$ Measurements in Kansas



Good correlations were observed for the Kansas City monitoring sites. Among the three monitoring sites in Kansas City on the Kansas side all these sites showed a >0.7 R^2 correlation and low relative difference. These three sites are also fairly well correlated with the Kansas City, Missouri monitors.

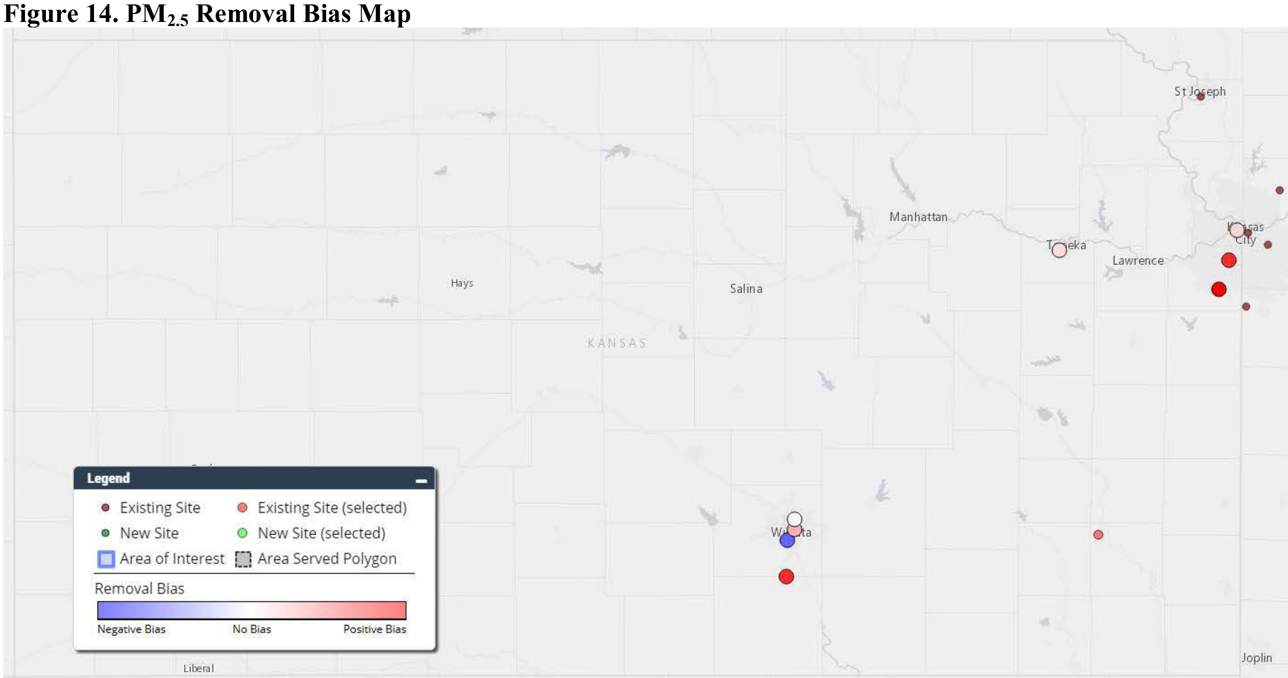
All four of the Wichita sites also show very high (> 0.8 R^2) correlation among each other. All four sites are located within 25 miles of each other. Note that not all monitors are included in the correlation tool based on data availability. Based on the correlation and the relative close distance between all sites it seems feasible that one of the Wichita $PM_{2.5}$ sites could be removed.

Topeka/KNI is an urban site not too far away (50 miles west) from the Kansas City urban center sites; this site does not show a correlation with the three Kansas City sites. The remaining sites are also further 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. So, those sites with large positive bias are more likely candidates to be removed or relocated because they are not measuring the peak $PM_{2.5}$ in the area. 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.

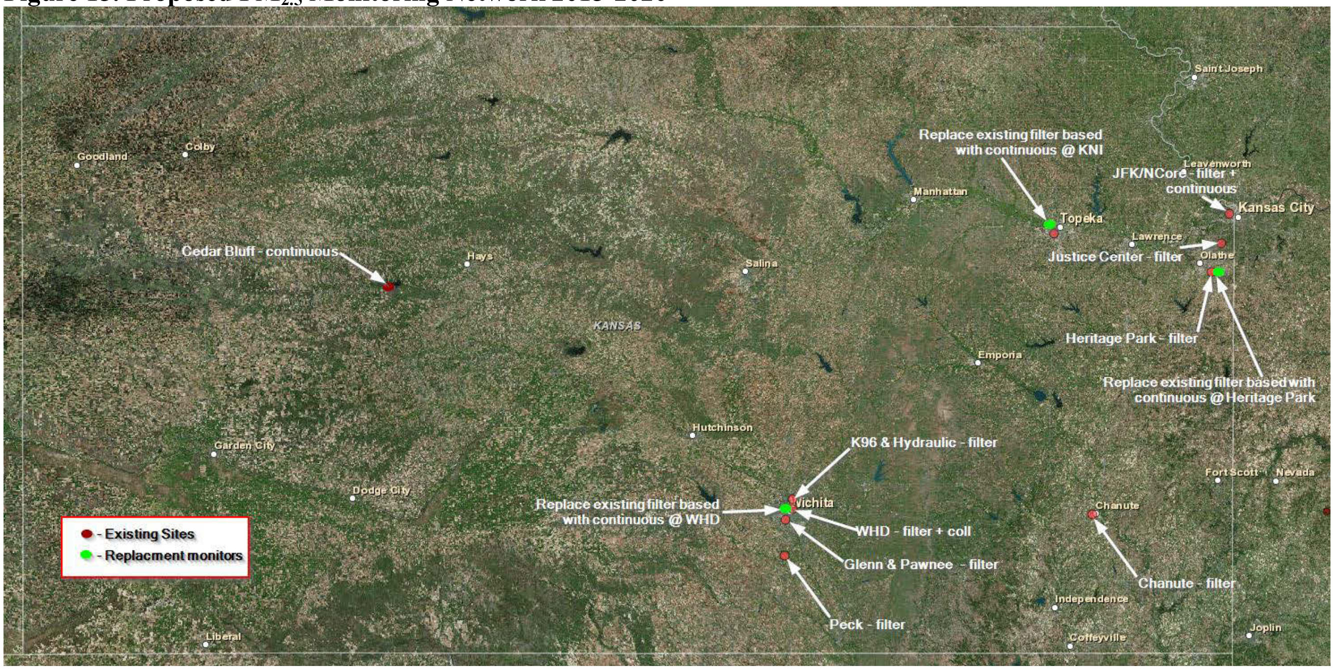
Figure 14. $PM_{2.5}$ Removal Bias Map



Proposed Kansas $PM_{2.5}$ Monitoring Network 2015-2020

After a careful review of all the above factors, the proposed Kansas $PM_{2.5}$ monitoring network for the upcoming 5 years is presented in Figure 15. This proposal reflects the population based monitoring requirements along with the current $PM_{2.5}$ monitored values. Overall, KDHE proposes to install continuous $PM_{2.5}$ monitors at Heritage Park and Topeka KNI. This will supplement the two current continuous monitors located at Cedar Bluff and the NCore site in Kansas City. In addition, a continuous 1405-DF monitor will be installed at the Wichita Health Department site in the next several years. KDHE will also examine the possibility of removing one $PM_{2.5}$ monitor in the Wichita area and one of the three monitors in Kansas City. KDHE will continue to make efforts, as funds allow, to replace filter based $PM_{2.5}$ monitors with continuous monitors across the network.

Figure 15. Proposed $PM_{2.5}$ Monitoring Network 2015-2020



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 9 (http://edocket.access.gpo.gov/2006/pdf/06-8478.pdf).

Table 9. PM_{10} Minimum Monitoring Requirements (Number of Stations per MSA) [1]

Population Category	High Concentration[2]	Medium Concentration[3]	Low Concentration[4]
> 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 10. According to Tables 9 and 10, PM_{10} monitors could be removed from the Wichita area and the Kansas City area assuming the Missouri side of Kansas City retains a PM_{10} monitor.

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

MSA	Population (2014)	Number of Existing PM_{10} Monitors	PM_{10} Monitors Required
Wichita, KS	641,076	3	1-2
Topeka, KS	233,758	1	0-1
Lawrence, KS	116,585	0	0
St. Joseph, MO-KS	127,431	0	0
Manhattan, KS	98,091	0	0
Kansas City, MO-KS	2,071,133	2 (KS side only)	2-4

State of Kansas Current PM_{10} Monitoring Network

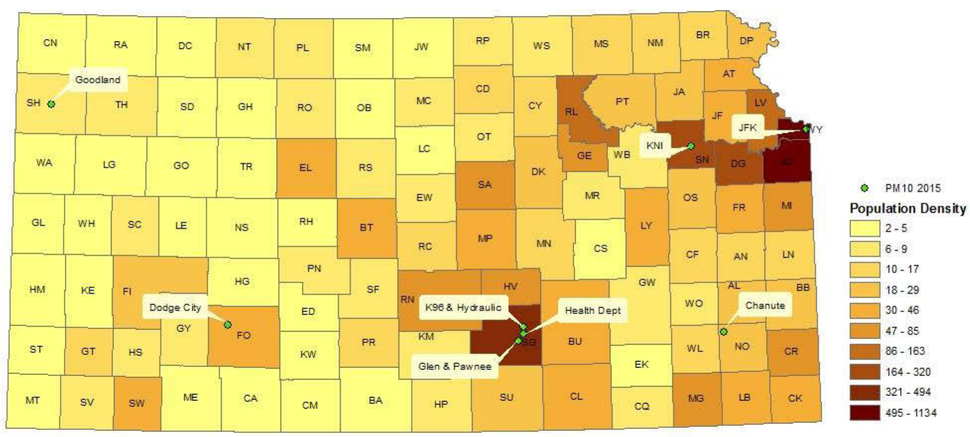
Current Kansas PM_{10} monitoring network includes 10 monitors located throughout the state at 8 monitoring sites. Three of the monitors are filter based while the remaining seven monitors are continuous. Monitor locations and type are listed in Table 11 along with detailed site information. One site at JFK/NCORE, has collocated filterable and continuous PM_{10} measurements.

Table 11. State of Kansas PM_{10} Monitor Site ID and Location

Site Name	Site ID	City	Address	Lat_DD	Lon_DD	Filter PM_{10}	Cont. PM_{10}
Dodge City	057 - 0002	Dodge City	Dodge City Community College	37.77527	-100.035	NO	YES
Glen & Pawnee	173 - 0009	Wichita	Fire Sta#12 Glen & Pawnee	37.651111	-97.362222	NO	YES
Health Dept.	173 - 0010	Wichita	Health Dept., 1900 East 9th St.	37.701111	-97.313889	NO	YES
Chanute	133 - 0002	Chanute	1500 West Seventh	37.676111	-95.474444	NO	YES
Goodland	181 - 0001	Goodland	City Fire Sta , 1010 Center	39.348333	-101.713056	YES	NO
JFK	209 - 0021	Kansas City	1210 N. 10th St., JFK Recreation Center	39.1175	-94.635556	YES+Colo	YES
K-96 And Hydraulic	173 - 1012	Wichita	K-96 And Hydraulic	37.747222	-97.316389	NO	YES
KNI	177 - 0013	Topeka	2501 Randolph Avenue	39.02427	-95.71128	NO	YES

Figure 16 shows the population density of the State of Kansas along with the monitoring sites. All of these monitors have 3 year design values in the Low (< 80% of the NAAQS) concentration category.

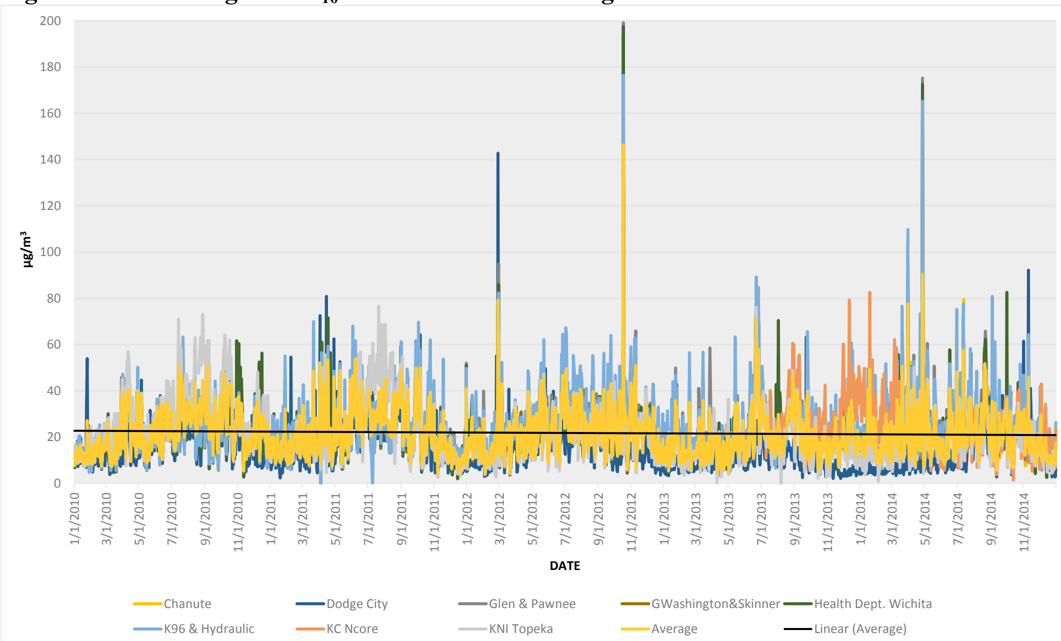
Figure 16. Kansas Population Density Map and PM_{10} Monitor Locations



PM_{10} Measurements Trend Analysis

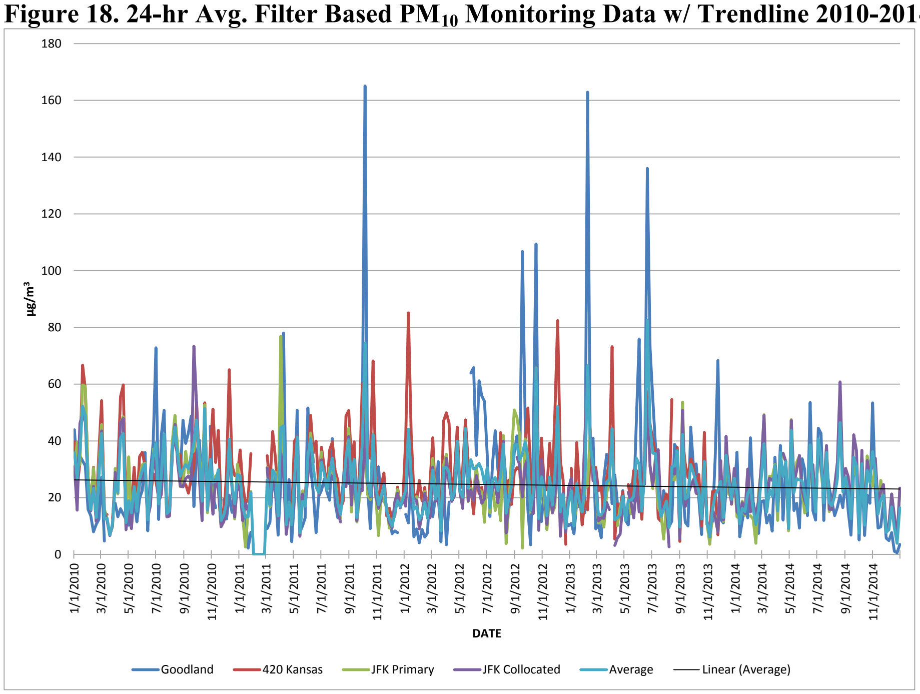
Both the continuous TEOM and filter based PM_{10} measurements were evaluated for trend analysis. For the continuous data the trend over the 5-year period, 2010-2014, has been slightly downward. Figure 17 shows the daily average of the eight continuous monitors along with the linear trendline. Overall, the average continuous readings across the state are well below the NAAQS standard. The two days of exceedances (Oct. 2012 & April 2014) were caused by dust storms and exceptional event requests letters have been submitted to EPA Region 7.

Figure 17. 24-hr Avg. of PM_{10} Continuous Monitoring Data w/ Trendline 2010-2014



Looking at the filter based one-in-six data, a slight downward trend was also apparent like the continuous data. Figure 18 shows the PM_{10} filter based monitoring data for PM_{10} sites in the state. Note the higher readings that occurred in 2011 and 2013. These two exceedances were located at the Goodland monitor and were both caused by dust storms associated with strong low pressure systems. Both of these days have been flagged and exceptional event requests were sent to EPA Region 7. EPA has concurred on the Goodland 2011 event. The important point is both the continuous and filter based monitors are all well below the standard. The 420 Kansas monitoring site in Kansas City, Kansas was removed at the end of the 2013.

Figure 18. 24-hr Avg. Filter Based PM_{10} Monitoring Data w/ Trendline 2010-2014



The design values for each of the PM_{10} monitors have been listed in Table 12. There are no values exceeding the current NAAQS. The Goodland monitor has the highest design value reading of 99 $\mu g/m^3$, is well below the 150 $\mu g/m^3$ standard. This monitor has been affected by several dust storms during this period which has increased its design value significantly. Several monitors do not have three years of data and no design values are provided for those monitors.

Table 12. PM_{10} Design Values for all Kansas Monitors ($\mu g/m^3$)

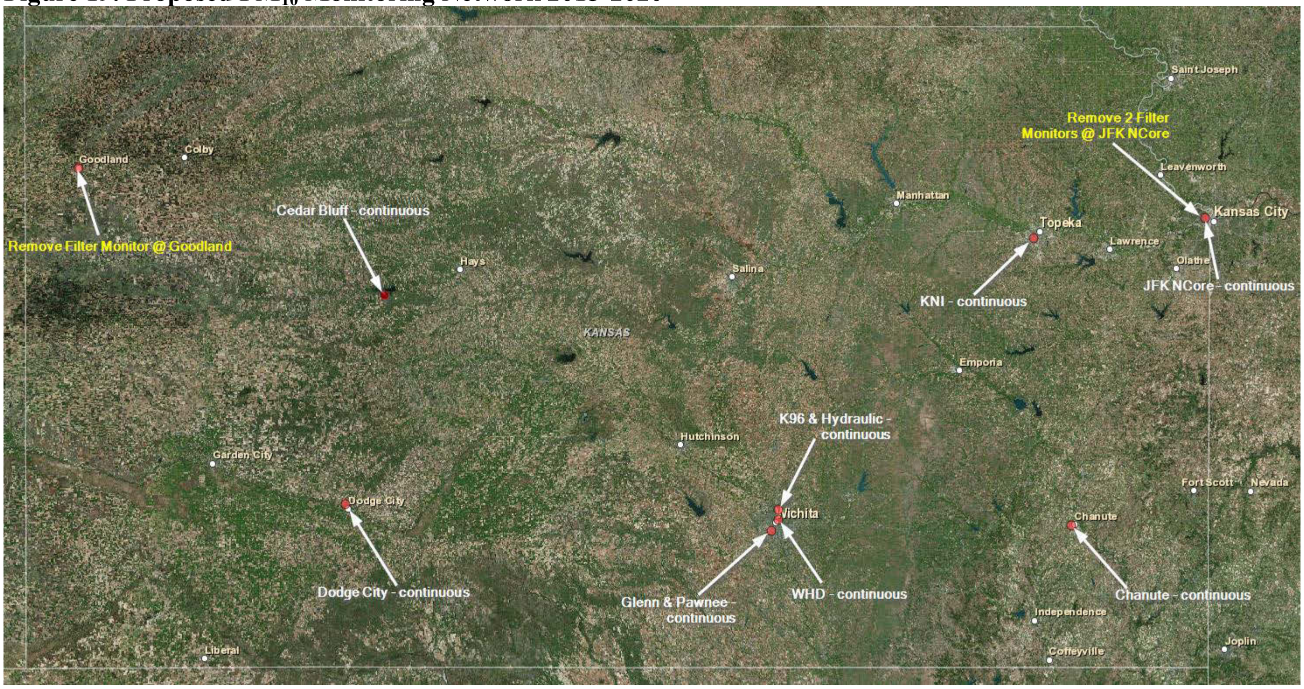
Site Name	2012 2nd High	2013 2nd High	2014 2nd High	12-14 Design Value
Chanute (TEOM)	*	*	80	**
Goodland	107	136	53	99
KCK JFK	51	44	49	48
KCK NCore	*	61	62	**
Dodge City (TEOM)	55	31	62	49
Washington & Skinner (TEOM)	86	36	*	**
Glen & Pawnee (TEOM)	95	71	103	90
Wichita Health Dept (TEOM)	86	71	104	87
K96 & Hydraulic (TEOM)	82	85	110	92
Topeka KNI (TEOM)	48	55	62	55

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

Proposed Kansas PM_{10} Monitoring Network 2015-2020

After a careful review of all the above factors, the proposed Kansas PM_{10} monitoring network for the upcoming 5 years is presented in Figure 19. This proposal reflects the population based monitoring requirements along with the current PM_{10} monitored values. Overall, KDHE proposes removing the filter based PM_{10} monitors in Goodland and in Kansas City. KDHE will replace the Goodland filter based monitor with a continuous monitor located at the Cedar Bluff monitoring site. KDHE has installed this monitor and is currently evaluating it against the Goodland monitor. This will leave eight continuous PM_{10} monitors, one in Dodge City, one at Cedar Bluff, three in Wichita, one in Chanute, one in Topeka and one in Kansas City, KS. KDHE will continue to examine the data from the three existing PM_{10} monitors in Wichita and decide whether there is a need for all of those sites in the future.

Figure 19. Proposed PM_{10} Monitoring Network 2015-2020



NCore Monitoring Site

National Ambient Air Monitoring Strategy

The Environmental Protection Agency (EPA) developed a National Ambient Air Monitoring Strategy (NAAMS). The goal of the strategy is "to improve the scientific and technical competency of existing air monitoring networks to be more responsive to the public, and the scientific and health communities, in a flexible way that accommodates future needs in an optimized resource-constrained environment" (National Ambient Air Monitoring Strategy Document). As part of the Strategy, a network design was proposed called the National Core Network (NCore). This network accommodates the overall strategic goals as well as determines air quality trends, report to the public, assess emission reduction strategy effectiveness, provide data for health assessments and help determine attainment / non-attainment status. NCore introduced a new multi-pollutant monitoring component, and addressed the following major objectives:

The NCore monitoring network addresses the following monitoring objectives which are equally valued at each site:

- timely reporting of data to the public through AIRNow, air quality forecasting, and other public reporting mechanisms;
- support 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;
- compliance through establishing nonattainment/attainment areas by comparison with the NAAQS;

- support of scientific studies ranging across technological, health, and atmospheric process disciplines; support long-term health assessments that contribute to ongoing reviews of the National Ambient Air Quality Standards (NAAQS); and
- support of ecosystem assessments, recognizing that national air quality networks benefit ecosystem assessments and, in turn, benefit from data specifically designed to address ecosystem analysis.

At a minimum, NCore monitoring sites must measure the parameters listed in Table 13.

Table 13. NCore Parameters

Parameter	Comments
$PM_{2.5}$ speciation	Organic and elemental carbon, major ions and trace metals (24 hour average every 3rd day)
$PM_{2.5}$ FRM mass	24 hour average every third day
continuous $PM_{2.5}$ mass	one hour reporting interval
continuous $PM_{(10-2.5)}$ mass	in anticipation of a $PM_{(10-2.5)}$ standard
lead (Pb)	24 hour sample every sixth day (first sample is required on December 29, 2011)
ozone (O_3)	continuous monitor consistent with other O_3 sites
carbon monoxide (CO)	continuous monitor consistent with other CO sites
carbon monoxide (CO) trace level	continuous monitor capable of trace levels (low ppb and below)
sulfur dioxide (SO_2)	continuous monitor consistent with other SO_2 sites
sulfur dioxide (SO_2) trace level	continuous monitor capable of trace levels (low ppb and below)
oxides of nitrogen (NO_X)	continuous monitor consistent with other NO_X sites
total reactive nitrogen (NO/NO_y)	continuous monitor capable of trace levels (low ppb and below)
surface meteorology	wind speed and direction, temperature, barometric pressure, and relative humidity

NCore Site - Urban

20-209-0021; Kansas City:
This site (Figs. 20-21), which currently serves as an urban core multi-pollutant monitoring station, is designated as a NCore station. The site is located close to Nebraska Ave and North 10th Street, Kansas City, Kansas (N 39.117219; W -94.635605).

Figure 20. Kansas City, KS JFK NCore Site Map

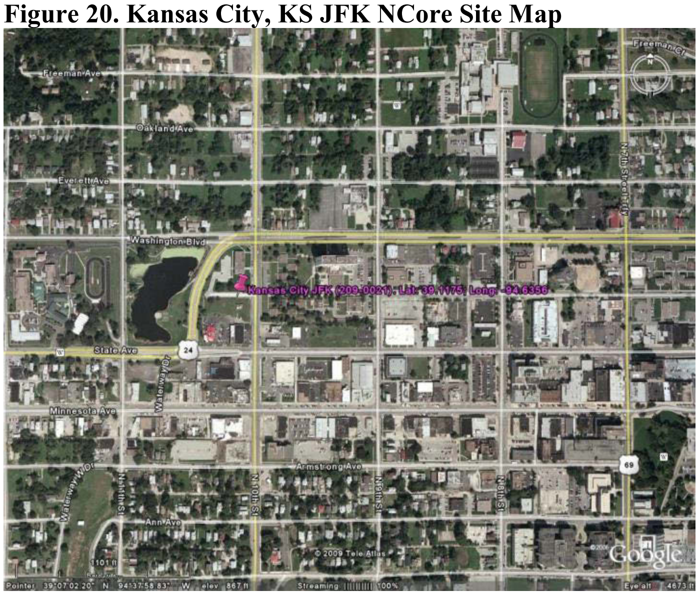


Figure 21. Kansas City, KS JFK NCore Site

KDHE does not plan to expand the NCore Monitoring Network in the near future.

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. This source is located at Salina.

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 taking into account the potential for population exposure, and logistics. Typically, dispersion modeling will be 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 Pb site near the Exide Technologies facility at Salina, KS has been designated with AQS site ID 020-169-0004. A high volume (HiVol), total suspended particulate (TSP) sampler is running at the site on a 1/6 day schedule and began sampling on February 2, 2010. KDHE installed an additional high volume (HiVol), total suspended particulate (TSP) sampler at the Salina monitoring site to use for collocation purposes in 2013. This monitor runs on the same 1/6 day sampling schedule as the existing lead monitor and was installed next to the existing monitor. The monitoring site is located at the following legal description:

SOUTH INDUSTRIAL AREA, S1, T15, R3, BLOCK 2, ACRES 13.4, LTS 21-
30 EXC E 32 LT 30

Figure 22. Salina, KS Lead Source Monitoring Site

Figure 23. Salina, KS Lead Source Monitoring Site Map

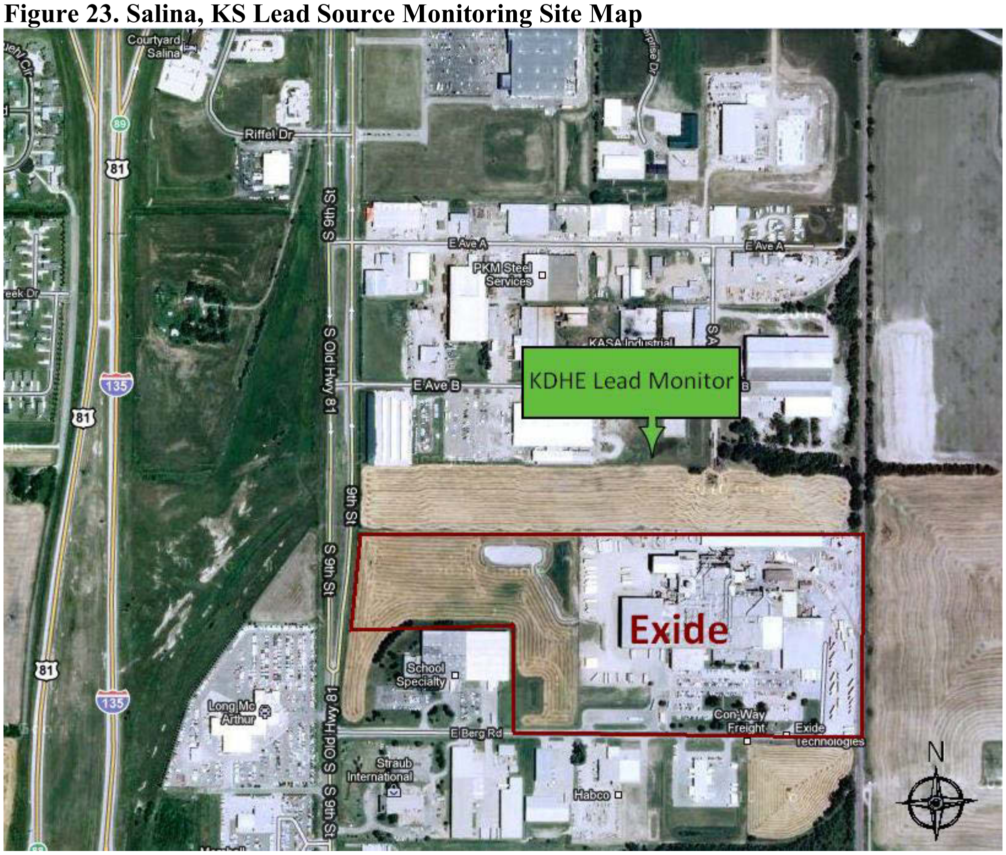
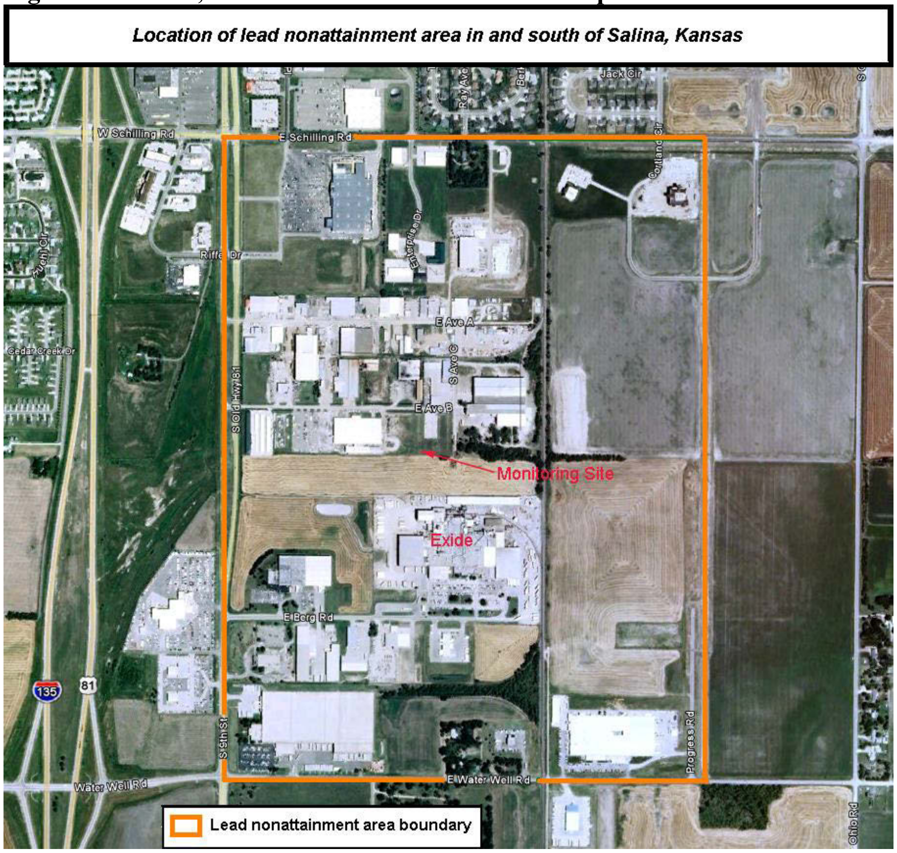


Figure 24. Salina, KS Lead Nonattainment Area Map



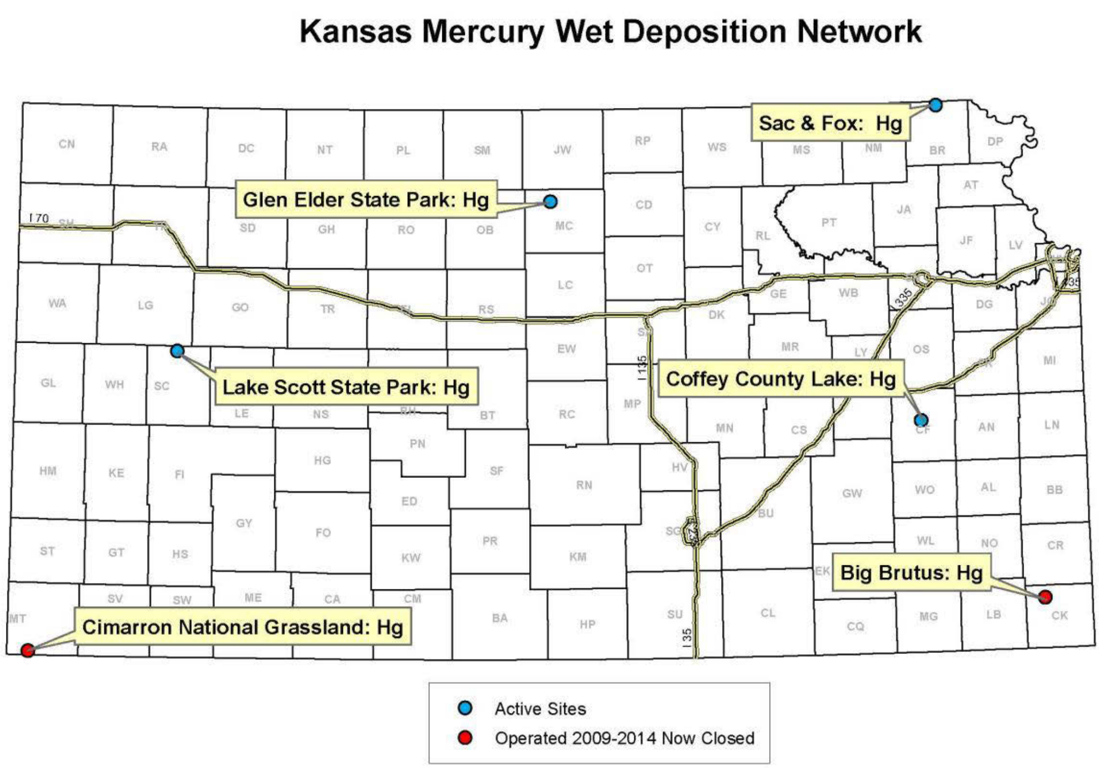
Population based Lead Monitoring

EPA also requires lead monitoring in large urban areas. These monitors are located along with multi-pollutant ambient monitoring sites (known as the "NCore network"). 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 is running at the site on a 1/6 day schedule and began running December 27, 2011 and took its first sample on January 4, 2012. Because of low values recorded at these NCore based lead monitor sites across the country, EPA has proposed to eliminate this monitoring requirement. As of April 2015, this proposal has not yet become finalized and lead monitoring will continue at this site.

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 re-examine 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 more detailed report on this network may be found at http://www.kdheks.gov/bar/air-monitor/mercury/Hg_Report.pdf. A map of the network appears below in Figure 25.

Figure 25. Proposed Mercury Wet Deposition Network (incl. recently closed sites) 2015-2020



Sulfur Dioxide Monitoring Network

On June 2, 2010, EPA revoked the primary annual and 24-hour SO_2 standards from 30 ppb and 140 ppb, respectively, to a 1-hour standard of 75 ppb. The new SO_2 rule, published June 22, 2010, also stated the following:

- Any new monitors must be in operation by January 1, 2013.
- Monitoring required in Core Based Statistical Areas (CBSA's) based

on population size and SO_2 emissions.

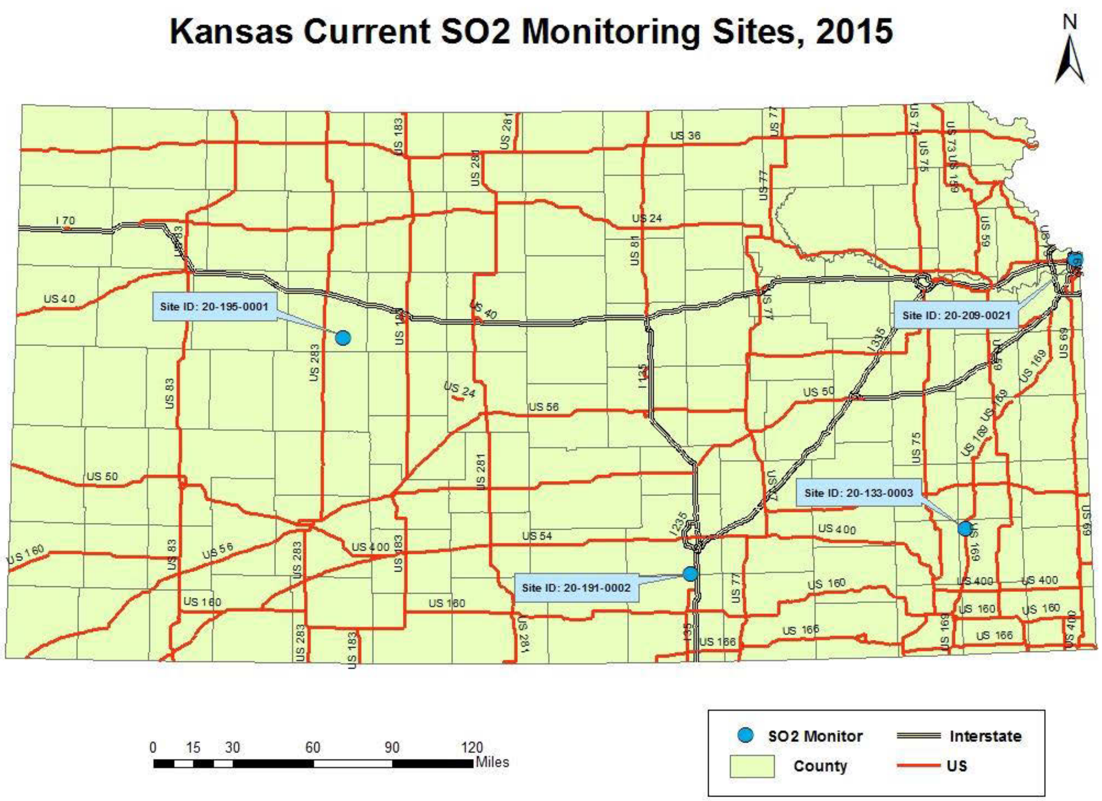
- Additional monitoring would also be required based on the state's contribution to national SO_2 emissions, which could be placed either within or outside a CBSA's.
- Reporting requirement added to include maximum 5-minute block average of each hour.

KDHE currently monitors for SO_2 at the following sites; Cedar Bluff, Peck (Wichita), Chanute and JFK (Kansas City).

Proposed Kansas Sulfur Dioxide Monitoring Network 2015-2020

KDHE intends to maintain the current configuration of its SO_2 network.

Figure 26. Proposed Sulfur Dioxide Monitoring Network 2015-2020



Nitrogen Dioxide Monitoring Network

The state is required by 40 CFR 58 Appendix D to install and operate one microscale near-road NO_2 monitoring station and it is to be operational by January 1, 2017. The state is beginning to perform preliminary analysis on the selection of an appropriate near-road monitoring site in Wichita and will wait funding to establish this site. (EPA is currently discussing the possibility of not proceeding with the implementation of this phase of the NO_2 Rule. As of the development of this plan, no final decisions have been made.) EPA amended the applicability requirements of 40 CFR 58 Appendix D in March of 2013 to address the near road monitoring network and introduced a phased approach to implementation of the network.

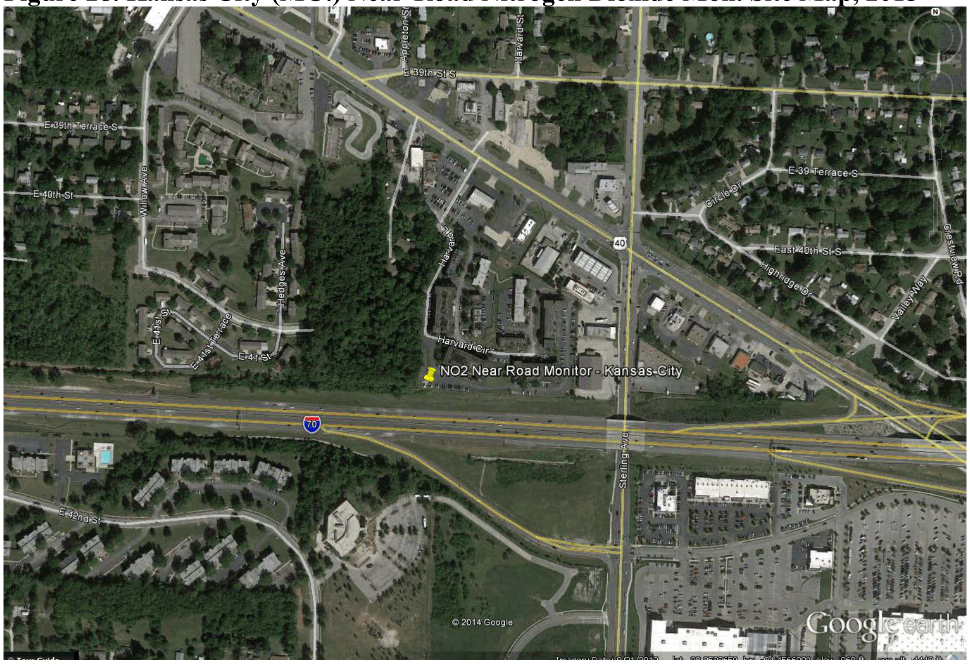
Two criteria have been set up for NO_2 monitoring:

- Near-road NO_2 monitoring; 1 micro-scale site would be required in CBSAs >= 350,000 at a location of expected highest hourly NO_2 concentrations sited near a major road with high AADT (Annual Average Daily Traffic) counts.
- Community-wide; required in CBSAs >= 1 million at a location of expected highest NO_2 concentrations representing neighborhood or larger (urban) spatial scale.

Based on the near-road criteria, one monitor site was installed in 2013 in the Kansas City Metropolitan Area by the Missouri Department of Natural Resources Air Pollution Control Program and is located near I-70 and Sterling Avenue (39.047911, -94.450513, Figures 27-28). Based on the community-wide criteria, the Kansas City CBSA would be required to have a monitor and the JFK NCore monitoring site (20-209-0021) satisfies this requirement.

Figure 27. Kansas City (MO.) Near-Road Nitrogen Dioxide Monitoring Site, 2015

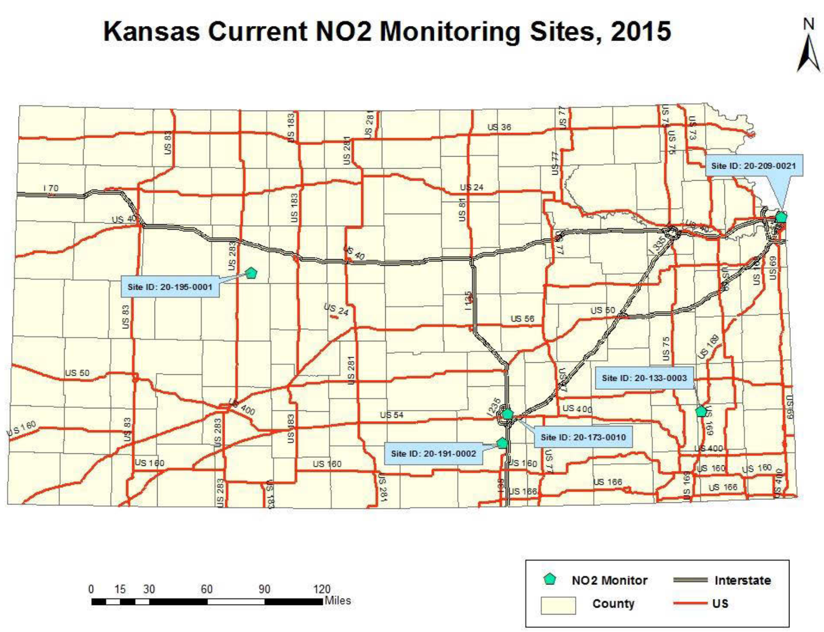
Figure 28. Kansas City (MO.) Near-Road Nitrogen Dioxide Mon. Site Map, 2015



Proposed Kansas Nitrogen Dioxide Monitoring Network 2015-2020

KDHE intends to maintain the current configuration of its NO_2 network.

Figure 29. Proposed Nitrogen Dioxide Monitoring Network 2015-2020



Carbon Monoxide

EPA conducted a review of the CO NAAQS and decided to retain the existing standards in 2011. The BOA currently has one CO monitoring site in the state (Figure 30). It is located at the JFK NCore site in Kansas City, KS.

Proposed Kansas Carbon Monoxide Monitoring Network 2015-2020

KDHE intends to maintain the current configuration of its CO network.

Figure 30. 2015 Carbon Monoxide Monitoring Network