Technical Support Document
for the Revocation of K.A.R. 28-19-719
Fuel Volatility

June 2020

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Division of Environment
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Executive Summary

This technical support document (TSD) is intended to support the proposed revocation of K.A.R. 28-19-719 *Fuel volatility*. The purpose of the analysis provided in this document is to demonstrate that removal of the summertime 7.0 pounds per square inch (psi) Reid Vapor Pressure (RVP) requirement for gasoline offered for sale in Johnson and Wyandotte Counties in Kansas complies with Section 110(l) of the Federal Clean Air Act (FCAA).

FCAA Section 110(l) applies to all areas of the country, whether attainment, nonattainment, unclassifiable or maintenance for one or more of the six criteria pollutants: ground-level ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and lead (Pb). The fuel requirement evaluated in this demonstration is in place to address ground-level ozone formation, therefore the focus of this TSD is to ensure continued attainment of the 2015 ozone standard in the Kansas City area. In addition, all other pollutant standards were reviewed and found to not be impacted or interfered with as a result of removing the RVP requirement.

The entireties of Johnson and Wyandotte counties are designated unclassifiable/attainment for the 2015 ozone NAAQS based on 2015 - 2017 monitoring and emissions data. Further, the area's design value remains in attainment of the 2015 ozone NAAQS based on the latest 3-year design value (2017 - 2019). Therefore, for both counties, the 2017 level of emissions represents an acceptable level to ensure that emissions in these two counties will not interfere with attainment or maintenance of the 2015 ozone standard.

In addition, modeled NO_x and VOC emissions for the area are projected to decrease when comparing 2017 actual emissions to the future year of 2020 without the summertime 7.0 psi RVP requirement. As a result, removal of the summertime 7.0 psi RVP requirement in these two Kansas counties will not interfere with attainment or maintenance of the 2015 ozone NAAQS.

Based on the analysis presented in this document, the removal of the RVP rule requirements will not interfere with continued attainment of the 2015 ozone standard and projected emissions will maintain below 2017 actual ozone emission levels; therefore, the Kansas Department of Health and Environment (KDHE) concludes that the removal of summertime 7.0 psi RVP requirement in Johnson and Wyandotte counties will not interfere with attainment, maintenance, or reasonable further progress for any NAAQS or with any other applicable requirement of the FCAA.

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List of Acronyms

BOA	Bureau of Air
CO	Carbon Monoxide
E85	Gasoline blended with 85%
EPA	Environmental Protection Agency
FCAA	Federal Clean Air Act
FR	Federal Register
KDHE	Kansas Department of Health and Environment
KDOT	Kansas Department of Transportation
MARC	Mid-America Regional Council
MDNR	Missouri Department of Natural Resources
MOVES	Motor Vehicle Emissions Simulator model
NAAQS	National Ambient Air Quality Standard
NEI	EPA's national emissions inventory
Nonroad	This emissions category includes motorized vehicles or equipment that are not typically licensed to operate on public roadways, including agricultural and construction equipment, lawn and garden equipment, mining and logging equipment, boats, freight handling equipment, and airport ground support equipment.
NO_x	Oxides of Nitrogen
Onroad	This emissions category includes motor vehicles that are licensed to operate on public roadways, including cars, trucks, buses, and motorcycles.
O_3	ozone
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometer
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
PSD	prevention of significant deterioration
RVP	Reid vapor pressure
SIP	state implementation plan
SO_2	Sulfur Dioxide
TPD	Tons per Day
TSD	technical support document
VMT	Vehicle Miles Traveled
VOC	volatile organic compounds

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Chapter 1: General

1.1 Introduction and Background

This technical support document (TSD) is intended to support the proposed revocation to K.A.R. 28-19-719: fuel volatility. The purpose of the analysis provided in this document is to demonstrate that removal of the summertime 7.0 pounds per square inch (psi) Reid Vapor Pressure (RVP) requirement for gasoline offered for sale in Johnson and Wyandotte Counties in Kansas complies with Section 110(l) of the Federal Clean Air Act (FCAA).

Historically, the Kansas portion of the Kansas City ozone area (formerly nonattainment area, followed by maintenance area, now attainment area) has included the Counties of Johnson and Wyandotte. The two-county area was part of the bi-state Kansas City sub-marginal ozone nonattainment area under the 1979 1-hr ozone National Ambient Air Quality Standard (NAAQS). The two-county area was also initially designated unclassifiable, and later designated attainment, under the 1997 8-hr ozone NAAQS. The U.S. Environmental Protection Agency (EPA) has redesignated the entire Kansas City sub-marginal 1-hour ozone nonattainment area to attainment and Kansas has approved maintenance plans for the 1997 and 1979 ozone standards.

Kansas is not revising its maintenance plans for the 1997 ozone standard or the 1979 1-hour ozone NAAQS concurrently with this summertime RVP SIP revision. As required, those maintenance plans addressed the period June 2004 through June 2014 or the 20-year maintenance period 1992 through 2012, respectively. Therefore, the maintenance periods associated with those plans have already passed. Further, both the 1979 ozone and 1997 ozone NAAQS are revoked in most areas of the country, including the bi-state Kansas City area. In addition, the area is currently designated unclassifiable/attainment under both the 2008 8-hr ozone NAAQS and the 2015 8-hr ozone NAAQS. The area has never been designated nonattainment under either of these more recent ozone NAAQS.

Further, the two Kansas City area (Kansas) counties of Johnson and Wyandotte are currently in attainment of all remaining NAAQS, with the sole exception of a current unclassifiable designation in Wyandotte County under the 2010 1-hour SO_2 NAAQS. With respect to the SO_2 NAAQS, EPA has recently proposed to redesignate Wyandotte County to attainment/unclassifiable for SO_2[1] and the summertime RVP requirement in Kansas City has no effect on SO_2 emissions.

[1] https://www.govinfo.gov/content/pkg/FR-2020-04-15/pdf/2020-07143.pdf

Chapter 2: FCAA Requirements

2.1 FCAA Requirements

Section 110(l) of the FCAA states –

> *The Administrator shall not approve a revision of a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in section 171), or any other applicable requirement of this Act.*

FCAA Section 110(l) applies to all areas of the country, whether attainment, nonattainment, unclassifiable or maintenance for one or more of the six criteria pollutants: ground-level ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and lead (Pb). The fuel requirement evaluated in this demonstration is in place to address ground-level ozone formation. Therefore, as outlined in Chapter 3 of this document, the focus of this demonstration is the maintenance of the 2015 ozone standard in the Kansas City area. Chapter 4 of this document provides a discussion regarding the Section 110(l) requirements for the remaining criteria pollutants.

Chapter 3: CAA Section 110(l) Demonstration – Ozone NAAQS

3.1 Introduction

This demonstration shows that removal of the summertime 7.0 psi RVP requirement in Johnson and Wyandotte Counties will not interfere with attainment or maintenance of all ozone standards, including the 2015 ozone NAAQS. Johnson and Wyandotte Counties are designated attainment/unclassifiable for all ozone NAAQS, specifically the 1979, 1997, 2008 and 2015 ozone NAAQS.

Table 1 provides the 2016-2018 and 2017-2019 ozone design values for each of the three ozone monitoring sites located on the Kansas side of the bi-state Kansas City area.

Table 1 - Kansas City Area (Kansas) Eight-hour Ozone Design Values*

Monitoring Site	Kansas County	2015-2017 Design Values (ppb)	2016-18 Design Value (ppb)	2017-19 Design Value (ppb)
Heritage Park	Johnson	59	61	59
Leavenworth**	Leavenworth	60	61	61
JFK	Wyandotte	62	64	62

* Quality assured data through December 31, 2019

** The Leavenworth monitor is in a county that is not subject to the summertime 7.0 psi RVP requirement but is adjacent to Kansas City area counties that are subject to the requirement.

As mentioned in Chapter 1 of this document, the entireties of Johnson and Wyandotte Counties are designated attainment/unclassifiable under the 2015 ozone NAAQS. These designations were based on 2015-2017 monitoring and emissions data. Further, the area's design value remains in attainment of the 2015 ozone NAAQS based on the latest 3-year design value (2017-2019). Therefore, for both counties, the 2017 level of emissions represents an acceptable level to ensure that emissions in these two counties will not interfere with attainment or maintenance of the 2015 ozone standard.

This chapter provides the results of a modeling analysis conducted by Sonoma Technology multiple mobile source emission modeling to determine the air quality impacts of the RVP rule revocation (Appendix A). Specifically, the results demonstrate the effect of removing the summertime 7.0 psi RVP gasoline requirement in Johnson and Wyandotte Counties and details how the removal relates to the area's attainment status for ozone. All emission figures included in this demonstration use the latest EPA approved mobile source emissions model, MOVES version 2014b. Appendix A of this document includes information regarding the development of the MOVES input files used in this demonstration. Bureau of Air (BOA) has also made all MOVES input and output electronic files available to the public upon request.

3.2 Base Year (2017) Total Mobile Source Emissions in Johnson & Wyandotte Counties

Table 2 below provides the 2017 baseline mobile source Nitrogen Oxide (NO_x) and Volatile Organic Compounds (VOC) emissions inventories for Johnson and Wyandotte Counties. The emissions are provided for each county

on the temporal scale of tons/ozone season day. These mobile source inventories include emissions from both onroad and nonroad mobile source emissions categories. Table 2 is based on an average weekday in July from 2017 and reflect emissions from these sectors while the summertime 7.0 psi RVP requirement was still in effect.

Table 2 - 2017 Total Mobile Source NO_x and VOC Emissions for Kansas City Area (KS) Counties

County	Scenario 1: Total Mobile Source Emissions - Onroad & Nonroad (tons/ozone season day)	
	NO_x	VOC
Johnson	21.19	13.96
Wyandotte	8.23	5.30
Area Total	29.42	19.26

3.3 2015 Ozone NAAQS – Summertime 7.0 psi RVP Revocation

Table 3 provides the projected total mobile source NO_x and VOC emissions in tons/ozone season day from the two counties under two scenarios for future year 2020, which correlates to the earliest summer in which the 7.0 psi RVP requirements may end. Scenario 2 assumes the summertime 7.0 psi RVP requirement remains in place for the two counties during these two future years, and scenario 3 assumes the removal of the summertime 7.0 psi RVP requirement for the two counties. Comparing these two scenarios allows one to determine the emissions benefit in 2020 of keeping the summertime 7.0 psi RVP requirements in place.

Table 3 - 2020 Total Mobile Source NO_x and VOC Emissions for Kansas City Area (KS) Counties (With and Without Summertime 7.0 psi RVP Gasoline)

County	Scenario 2: With 7.0 psi RVP		Scenario 3: Without 7.0 psi RVP	
	NO_x (tons/O_3 day)	VOC (tons/O_3 day)	NO_x (tons/O_3 day)	VOC (tons/O_3 day)
Johnson	16.15	12.38	16.18	12.64
Wyandotte	6.27	4.50	6.31	4.61
Area Total	22.42	16.88	22.49	17.25
Total Difference from Scenario 2			+0.07	+0.37

As shown in Table 3, the removal of the summertime 7.0 psi RVP requirement in Johnson and Wyandotte Counties is expected to result in an increase of 0.07 and 0.37 tons per ozone season day for total NO_x and total VOC emissions, respectively, when compared to the scenario in 2020 when the summertime 7.0 psi RVP requirements for these two counties remain in place.

However, comparison of the 2017 (actual) emission levels to the 2020 emission levels in scenario 3 without the summertime 7.0 psi RVP requirement for these two counties shows that even absent the summertime 7.0 psi RVP requirement, total mobile source emissions in 2020 reduce compared to emission levels in 2017. Specifically, as shown below in Table 4, emissions of NO_x are expected to reduce by 6.93 tons per ozone season day for 2020 even without the emissions benefit of the summertime 7.0 psi RVP requirement. Further, VOC emissions are

expected to reduce by 2.01 tons per day for 2020 even without the emissions benefit of the summertime 7.0 psi RVP requirement. These reductions were calculated by comparing the MOVES emission output values for 2017 and 2020. The projected reductions are the result of normal fleet turnover between 2017 and 2020. As older, higher-emitting vehicles and equipment in the region are retired and replaced with newer, lower-emitting vehicles and equipment meeting the latest emission control requirements, this reduces mobile source emissions throughout the region over time. The figures following Table 4 provide a graphical representation of the mobile source NO_x and VOC emissions for the Kansas portion of the bistate Kansas City area for the 2017 baseline and both 2020 modeled scenarios.

These two counties were designated unclassifiable/attainment for the 2015 ozone NAAQS based on 2017 data. Also, modeled NO_x and VOC emissions are projected to decrease when comparing 2017 actual emissions to the future year of 2020 without the summertime 7.0 psi RVP requirement. As a result, removal of the summertime 7.0 psi RVP requirement in these two Kansas counties will not interfere with attainment or maintenance of the 2015 ozone NAAQS.

Table 4 - Total Decrease in Mobile Source Emissions 2017 (Actual) vs 2020 (Without 7.0 psi RVP Gasoline)

County	NO_x (tons/O_3 day)	VOC (tons/O_3 day)
Johnson	-5.01	-1.32
Wyandotte	-1.92	-0.69
Total	-6.93	-2.01

Figure 1 - Modeled Mobile Source NO_x Emissions (Johnson and Wyandotte Counties)

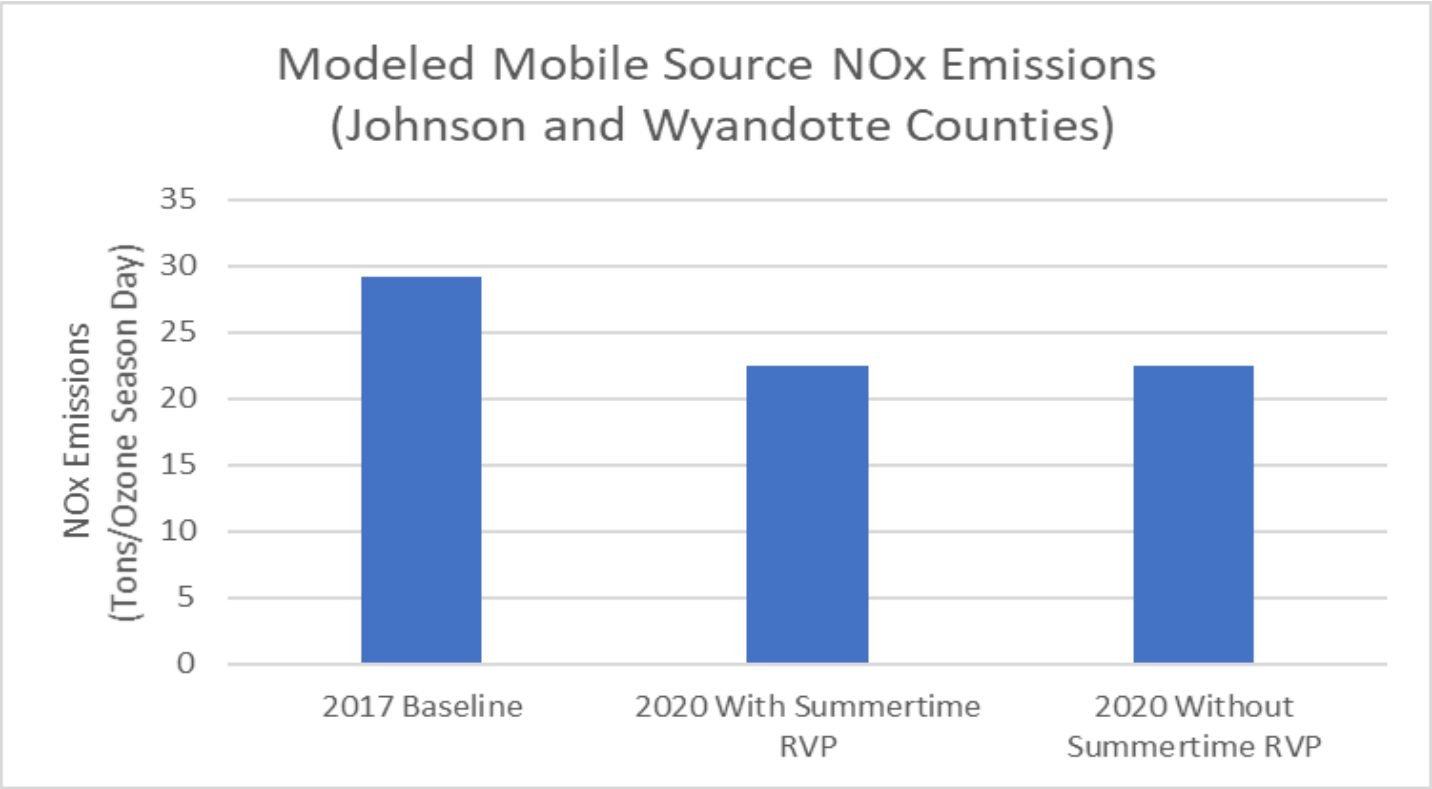
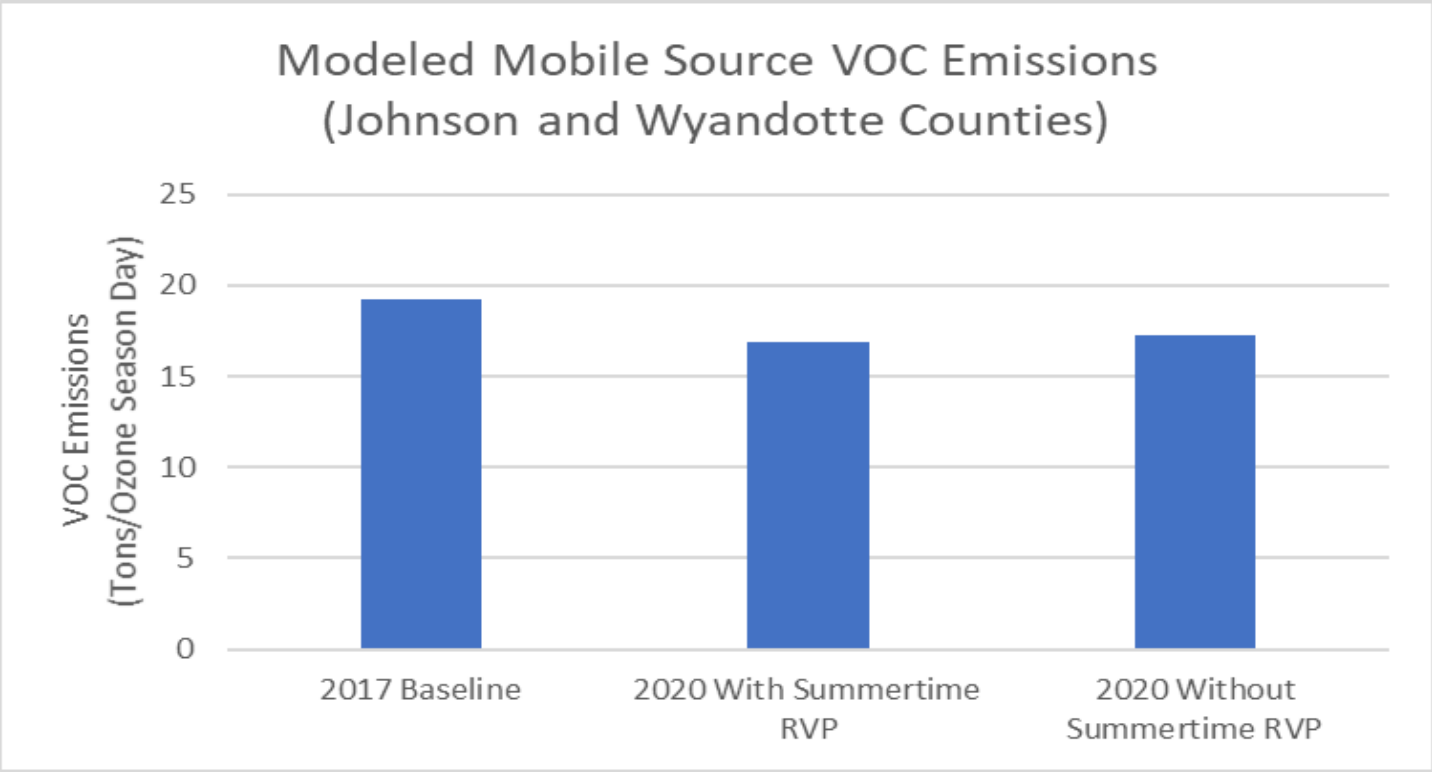


Figure 2 - Modeled Mobile Source VOC Emissions (Johnson and Wyandotte Counties)



Chapter 4: CAA Section 110(l) Demonstration – Other NAAQS

4.1 PM NAAQS

Direct emissions of $PM_{2.5}$ come from numerous types of emission sources, including onroad and nonroad mobile sources. $PM_{2.5}$ can also be formed through the chemical reaction of $PM_{2.5}$ precursor pollutants. The main precursor pollutants for $PM_{2.5}$ are NO_x, SO_2, VOC, and ammonia. Direct $PM_{2.5}$ emissions, and emissions of ammonia and SO_2 from mobile sources are not impacted by the summertime RVP requirements in the area. As mentioned in Chapter 3 of this document, changing the summer gasoline 7.0 psi RVP requirements do result in small emissions increases of VOC and NO_x when compared to the scenario where the requirements remain in place in 2020, but emissions of these pollutants are still anticipated to reduce when comparing the 2017 baseline to the 2020 scenario without the requirements in place.

The current 2017-2019 PM design values for the Kansas City area are below the level of the 2012 annual primary and the 2006 24-hour $PM_{2.5}$ NAAQS. Considering these current levels of PM concentrations and the anticipated continued aggregate reductions in mobile source emissions throughout the region without the summertime 7.0 psi RVP requirements in place, this demonstrates the proposed revocation will not interfere with the Kansas City area's ability to attain or maintain the annual primary and 24-hour $PM_{2.5}$ NAAQS.

4.2 NO_2 NAAQS

There are currently two primary nitrogen dioxide (NO_2) standards. On February 9, 2010 (75 FR 6474), EPA established a 1-Hour NO_2 standard set at 100 ppb. In 1971, an annual standard was set at a level of 53 ppb and has remained unchanged. EPA designated all counties in Kansas, including those in the Kansas City area as unclassifiable/attainment for the 2010 NO_2 NAAQS on February 17, 2012 (77 FR 9532). Currently, Kansas City's 2017-2019 design value for the 2010 1-hour NO_2 NAAQS is 42.0 ppb (less than half the level of the 2010 standard). In addition, the Kansas City area 2017-2019 design value for the annual standard is 8.0 ppb (around 15% of the NAAQS). Given the area is significantly below the level of the NAAQS in both the one hour and annual, and aggregate mobile source NO_x emissions in the region are anticipated to continue declining even without the summertime 7.0 psi RVP requirements in place, this demonstrates the proposed revocation will not interfere with attainment or maintenance of the 1-hour or annual NO_2 NAAQS.

4.3 SO_2 NAAQS

SO_2 emissions from on-road and nonroad mobile sources in the Kansas City region are not impacted by the continued implementation of the summertime 7.0 psi RVP requirements. Therefore, the proposed revocation will not interfere with attainment, maintenance, or reasonable further progress with respect to the 2010 SO_2 standard.

4.4 CO NAAQS

The 1-hour CO standard is 35 ppm and the 8-hour CO standard is 9 ppm. Compliance with both standards is determined by comparing the second maximum recorded concentrations for these averaging times each year. The JFK CO monitor in Wyandotte County, Kansas has recorded CO data since 1999. The highest recorded CO concentrations for any year at this monitor since it began operating is 7.1 ppm for the second maximum 1-hour average concentration and 5.0 ppm for the second maximum 8-hour average concentration. Based on these

measured CO concentrations, which are below the level of the standards, the proposed revocation will not interfere with attainment or maintenance of the 1-hour or 8-hour CO NAAQS.

4.5 Lead (Pb) NAAQS

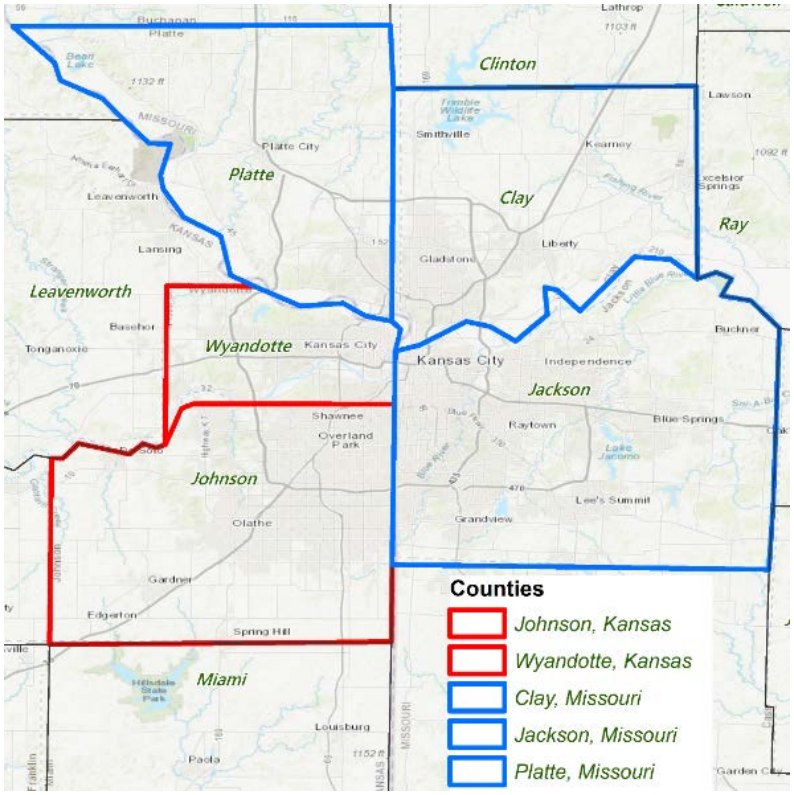
Lead emissions from on-road and nonroad mobile sources in the Kansas City region are not impacted by the continued implementation of the summertime 7.0 psi RVP requirements. Therefore, the proposed revocation will not interfere with attainment or maintenance of the 2008 lead standard.

Chapter 5: Conclusion

Based on the analysis presented in this document, the removal of summertime 7.0 psi RVP requirement in Johnson and Wyandotte counties will not interfere with attainment, maintenance, or reasonable further progress for any NAAQS or with any other applicable requirement of the CAA. Therefore, the removal of the summertime 7.0 psi RVP requirement in these two Kansas counties complies with Section 110(l) of the CAA.

Appendix A – MOVES Modeling Analysis for Johnson & Wyandotte Counties, Kansas

MOVES Modeling Analysis for Johnson and Wyandotte Counties, Kansas



Report Prepared for

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STi | Sonoma Technology

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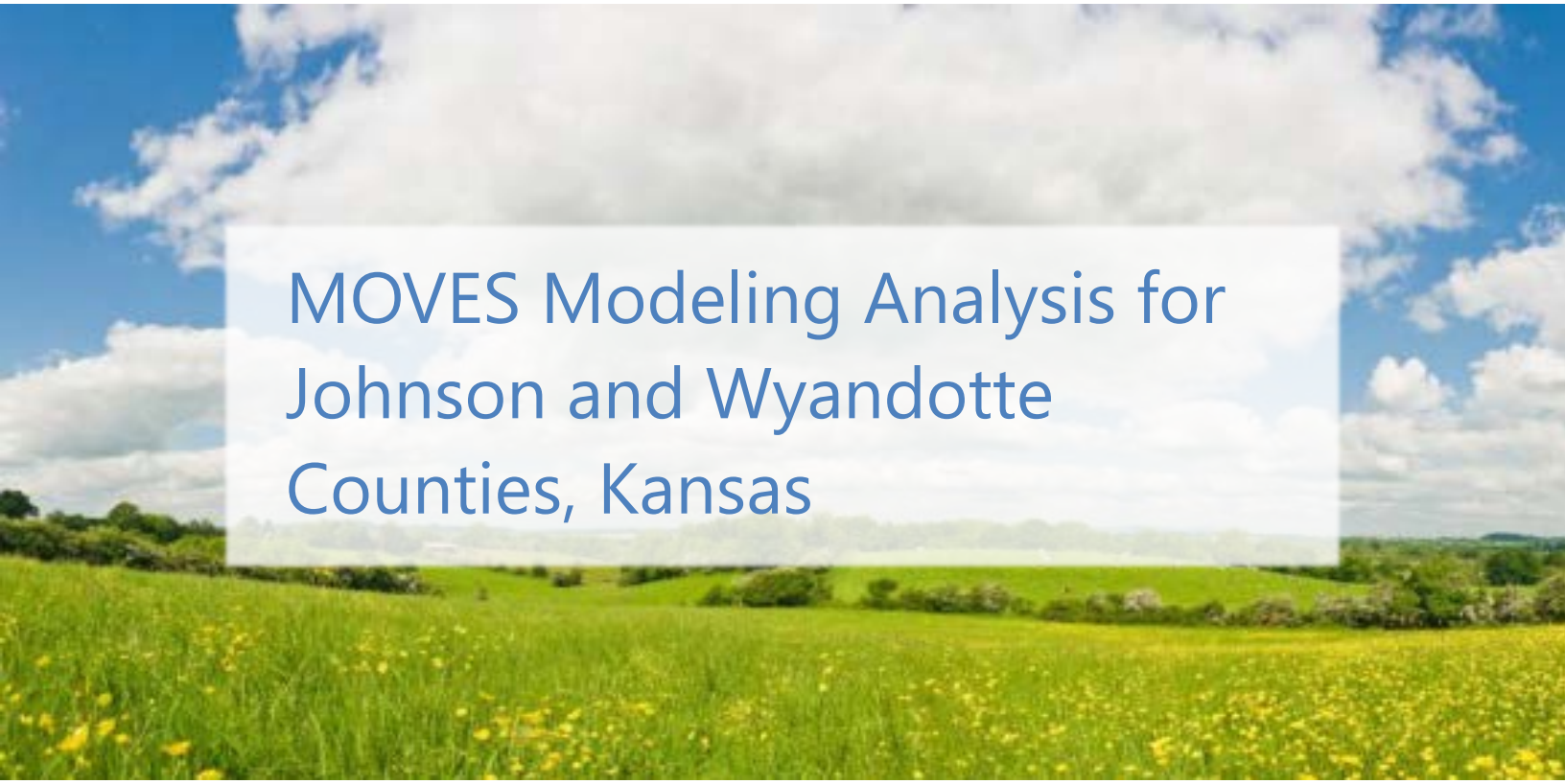

MOVES Modeling Analysis for Johnson and Wyandotte Counties, Kansas

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Cover image shows the MOVES modeling region for the Kansas City area. See Section 1 for details.

Disclosures

The Kansas Corn Commission provided funding support for this analysis. Sonoma Technology, Inc., conducted the technical work as directed by the Kansas Department of Health and Environment.

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Glossary

Term	Definition
E85	Gasoline blended with 85% ethanol
EPA	Environmental Protection Agency
KDHE	Kansas Department of Health and Environment
KDOT	Kansas Department of Transportation
MARC	Mid-America Regional Council
MDNR	Missouri Department of Natural Resources
MOVES	Motor Vehicle Emissions Simulator model
NAAQS	National Ambient Air Quality Standards
NEI	EPA's National Emissions Inventory
Nonroad	This emissions category includes motorized vehicles or equipment that are not typically licensed to operate on public roadways, including agricultural and construction equipment, lawn and garden equipment, mining and logging equipment, boats, freight handling equipment, and airport ground support equipment.
NOx	Oxides of Nitrogen
Onroad	This emissions category includes motor vehicles that are licensed to operate on public roadways, including cars, trucks, buses, and motorcycles.
psi	Pounds per square inch
RVP	Reid Vapor Pressure (a measure of the evaporative potential of gasoline)
SIP	State Implementation Plan
TPD	Tons Per Day
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

Executive Summary

The state of Kansas is pursuing revocation of the existing gasoline Reid Vapor Pressure (RVP) requirements for the Kansas City region, which encompasses Johnson and Wyandotte counties in Kansas. The RVP requirements limit the volatility of motor vehicle gasoline during the summer ozone season. The current summertime RVP requirements are 7.0 pounds per square inch (psi) RVP for conventional gasoline and 8.0 psi RVP for ethanol blends; the state is proposing to apply the national attainment area summertime requirements of 9.0 psi for conventional gasoline and 10.0 psi for ethanol blends.

Before the State of Kansas can remove its current RVP limit, the state must develop, and the U.S. Environmental Protection Agency (EPA) must approve, a revision of its State Implementation Plan (SIP). The SIP revision must demonstrate that the change in RVP requirements will not interfere with attainment or maintenance of the National Ambient Air Quality Standards (NAAQS). The required technical analysis to support this demonstration involves using EPA's Motor Vehicle Emissions Simulator (MOVES) model to quantify the effects of the proposed RVP revocation on volatile organic compounds (VOC) and oxides of nitrogen (NO_x) emissions from mobile sources. This report documents the technical analysis conducted to assess the effects of a proposed change in RVP limits on emissions in Johnson and Wyandotte counties in Kansas.

MOVES2014b was used to model VOC and NO_x emissions from mobile sources in Johnson and Wyandotte counties, Kansas. Three scenarios were modeled: (1) calendar year 2017, to represent a baseline year; (2) year 2020 with the existing RVP requirement; and (3) year 2020 with the attainment area RVP requirement. Input data were obtained from the 2017 Kansas National Emission Inventory submittal, from similar modeling conducted by the Missouri Department of Natural Resources for the Missouri counties in the Kansas City area, and from Kansas Department of Transportation.

Results from this analysis are summarized in Table 1. The modeling demonstrates that, if the summertime RVP requirements are not changed, mobile source emissions in Johnson and Wyandotte counties are expected to decline (by 12.4% for VOC, and 23.8% for NO_x) between 2017 and 2020. If the summertime RVP requirements are revoked, emissions of VOC and NO_x are still expected to decline between 2017 and 2020; however, the decline would be 10.4% for VOC and 23.6% for NO_x. The 2020 emissions for the attainment area RVP scenario would be slightly higher than for the existing RVP scenario, by 2.2% for VOC and 0.3% for NO_x.

Table 1. Summary of MOVES modeling results (tons per day). Data represent the sum of average July weekday onroad and nonroad emissions from Johnson and Wyandotte counties.

	Scenario 1: 2017 Baseline	Scenario 2: 2020, Current RVP	Scenario 3: 2020, Attainment Area RVP
NOx	29.42	22.42	22.49
VOC	19.26	16.88	17.25

Since ozone is formed from VOC and NO_x emissions, this decline in emissions even with revocation of the RVP requirements suggests that the proposed RVP revocation should not negatively impact ozone NAAQS attainment in the region. These results can be used as part of a technical support document to support a SIP revision for the state of Kansas. Additional documentation beyond the scope of this report is needed to support a SIP revision, such as presentation of ozone monitoring data trends and a discussion of the potential effects of the RVP revocation on pollutants other than ozone.

1. Introduction

This report summarizes emissions modeling conducted with the Environmental Protection Agency's (EPA) Motor Vehicle Emissions Simulator (MOVES) model in support of a proposed revision to the Kansas State Implementation Plan (SIP). The states of Kansas and Missouri are pursuing revocation of the existing gasoline Reid Vapor Pressure (RVP) requirements for the Kansas City region. The RVP requirements limit the volatility of motor vehicle gasoline during the summer ozone season (June 1 through September 15). The current requirements for the summer months are 7.0 pounds per square inch (psi) RVP for conventional gasoline and 8.0 psi RVP for ethanol blends;[1] the states wish to apply the national attainment area summertime requirements which are 9.0 psi for conventional gasoline and 10.0 psi for ethanol blends. For this change to take effect, each state must develop and receive EPA approval of a SIP revision for this change. Section 110(l) of the Clean Air Act stipulates that the SIP revision must demonstrate that the proposed change will not interfere with attainment or maintenance of the National Ambient Air Quality Standards (NAAQS).

EPA Region 7 provided the two states a document entitled "Technical Information for Kansas City, KS-MO State Fuel Rule Revision," dated April 24, 2019. This document spells out the technical process for assessing the emissions impact of the proposed change to RVP limits. To summarize, each state must model volatile organic compounds (VOC) and oxides of nitrogen (NO_x) emissions from onroad and nonroad mobile sources for (1) calendar year 2017, to represent a base year; (2) calendar year 2020 with the existing RVP requirement; and (3) calendar year 2020 with the attainment area RVP requirement. This information is then used to determine whether the proposed revision will negatively impact the ability of the area to remain in compliance with the NAAQS.

The Missouri Department of Natural Resources (MDNR) has already completed the emissions modeling for its SIP revision, based on the procedure outlined above. The Kansas Department of Health and Environment (KDHE) retained Sonoma Technology, Inc. (STI) to perform the MOVES modeling in support of its SIP revision. **Figure 1** identifies the counties in the Kansas City region covered by the MDNR and KDHE MOVES modeling analyses. The KDHE MOVES modeling described in this report covers the two counties in Kansas, Johnson, and Wyandotte counties.

[1] The Clean Air Act (CAA) provides a 1.0 psi RVP allowance for gasoline containing ethanol at 9 to 10 percent by volume (CAA section 221(h), 42 U.S.C. 7545(h)).

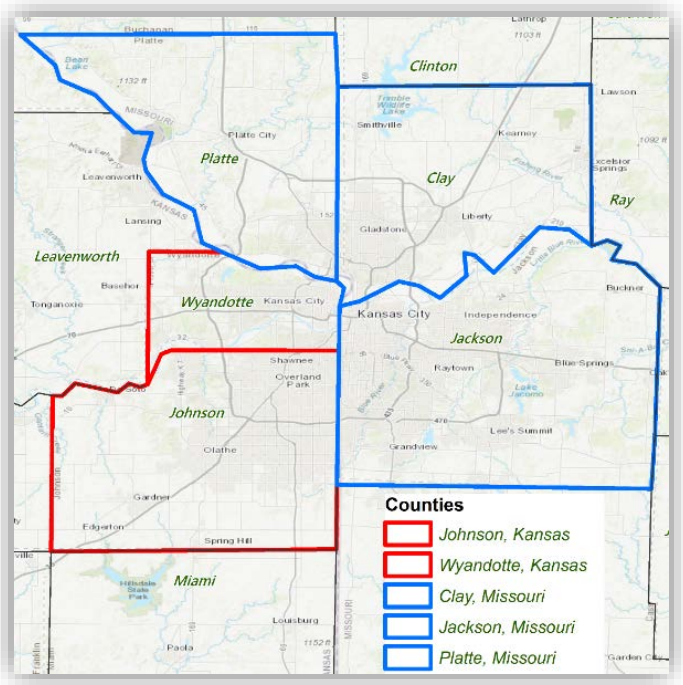

Figure 1. Map of MOVES modeling region for the Kansas City area. The KDHE MOVES analysis includes Johnson and Wyandotte counties.

2. Modeling Approach

MOVES2014b was used for the emissions modeling analysis. The primary sources of information used in the modeling were (1) the MOVES runs conducted by MDNR to support its SIP revision; (2) the MOVES inputs for the 2017 Kansas National Emission Inventory (NEI) submittal;[2] and (3) 2017 vehicle miles traveled (VMT) data from the Kansas Department of Transportation (Kansas DOT). Modeling was performed for the two Kansas counties that are part of the Kansas City ozone area—Johnson and Wyandotte. MOVES was used to estimate both onroad and nonroad emissions of VOCs and NO_x.

Three scenarios were modeled with MOVES2014b:

1. Year 2017 with the existing RVP requirement, to represent a baseline year
2. Year 2020 with existing summertime RVP requirement
3. Year 2020 with attainment area summertime RVP requirement

This analysis compares the modeled emissions among these scenarios to assess how emissions will change over time if the RVP requirements are equivalent to the requirements for areas attaining the ozone standard, and to assess the impact of applying those requirements on future emissions. To the extent possible, we strove to make this analysis for the Kansas counties consistent with the MDNR analysis for the Missouri counties, since they are part of the same metropolitan area, and to allow for an "apples-to-apples" comparison of analysis results across the two states. MDNR provided the MOVES files associated with their analysis. MDNR also provided a draft of the Technical Support Document[3] for their pending SIP revision that summarizes the results of their analysis and provides documentation for most of the inputs used in their MOVES modeling.

The emissions modeling analysis is based on the latest available planning assumptions. Many of the important inputs in this analysis are identical to those used in the Missouri analysis, including the meteorology data, VMT and vehicle population growth rates, most fuel inputs, and all of the nonroad modeling inputs. EPA's MOVES technical guidance[4] requires some inputs to be different, such as total VMT and vehicle population. In some cases, Kansas had more recent data available, and in others, the sources of MDNR inputs were not documented.

Table 2 summarizes the sources of MOVES inputs for the KDHE MOVES modeling analysis. The input data for the Kansas analysis, and similarities and differences between the input data for the two states' analyses, are discussed in detail below.

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[2] Downloaded from ftp://newftp.epa.gov/air/nei/2017/doc/supporting_data/onroad/draft_inputs/CDBs/.

[3] *Technical Support Document for the Rescission of 10 CSR 10-2.330 Control of Gasoline Reid Vapor Pressure*, available at https://apps5.mo.gov/proposed-rules/ecmView.action?rulemakingDocImgId=1585 (accessed 2/21/2020).

[4] MOVES2014, MOVES2014a, and MOVES2014b Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity. August 2018. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100V7EY.pdf.

Table 2. Summary of MOVES input data sources for the KDHE analysis.

Input	2017 Runs	2020, 2020 RVP Runs
Age Distribution, Speeds, Travel by Road Type, Month and Day VMT Fractions	Kansas 2017 NEI inputs	Kansas 2017 NEI inputs
Vehicle Population	Kansas 2017 NEI inputs	Kansas 2017 NEI inputs grown to 2020 using MDNR growth rate
Vehicle Miles Traveled	Kansas 2017 NEI inputs, corrected to match 2017 Kansas DOT data	2017 VMT grown to 2020 using MDNR growth rate
Fuel Supply, Fuel Formulation	Kansas 2017 NEI inputs	MDNR 2020 inputs
Fuel Usage Fraction (E85 use)	Kansas 2017 NEI inputs	Kansas 2017 NEI inputs
Vehicle Technology Fractions ("AVFT"), Meteorology	MDNR inputs	MDNR inputs

2.1 Onroad MOVES Runs

2.1.1 MOVES runspecs

The MOVES runspecs[5] for developing onroad emissions were based on the runspecs prepared by MDNR for the Missouri counties. They follow EPA's guidance for SIP-related MOVES analysis. There are three sets of runspecs for each county: (1) a 2017 base run; (2) a 2020 base run with the current RVP requirements in place; and (3) a 2020 run with the attainment area RVP requirements in place. The runspecs for both 2020 scenarios are identical, except for referencing different input databases with the different fuel requirements.

MOVES was run at the County scale to produce onroad emissions inventories. As in the MDNR analysis, a July weekday was modeled at the hourly scale, with all hours selected.[6] Modeling July conditions for ozone season analysis is a recommended option under EPA's MOVES technical guidance,[4] and weekdays are typically modeled instead of weekends because emissions-producing

[5] A runspec is a MOVES Run Specification that defines the place and time period of the analysis, as well as the vehicle types, road types, fuel types, emission processes, and pollutants that are included in the analysis.
[6] The MDNR runspecs were set up to model both weekdays and weekend days, but only the weekday results were presented in the MDNR Technical Support Document.

activity is normally higher on weekdays.[7] The modeling includes all road types, vehicle types, and fuel types. Emissions of VOCs and NOx were modeled for all emissions processes. Unique input and output databases were prepared for each run, using the input data described below. The inputs differ for each county, unless noted otherwise.

2.1.2 Age Distribution

The 2017 age distributions used are from the 2017 Kansas NEI submittal. These were used for both the year 2017 modeling and the year 2020 modeling, consistent with MDNR's approach.

2.1.3 Vehicle Population

The vehicle (sourcetype) population estimates used for the year 2017 modeling are from the 2017 Kansas NEI submittal. To develop year 2020 population estimates, the same vehicle population growth rates used by MDNR in developing its inputs were applied: 0% growth in cars and buses, 3% annual growth in motorcycles, and 4.6% annual growth in trucks.[8] These growth rates result in roughly 7.5% total growth in the vehicle fleet in Johnson and Wyandotte counties over three years. By comparison, use of the MOVES default growth rates would result in 2.8% growth in the vehicle fleet over three years.

2.1.4 Fuels

MOVES uses four inputs to describe onroad fuels: Fuel Supply, Fuel Formulation, Fuel Usage Fraction, and AVFT (Alternative Vehicle and Fuel Technologies). The Kansas City area is part of a larger fuel region with consistent fuels, so the inputs for the MDNR and KDHE analyses are for the most part identical, and the KDHE inputs are the same for each county.

The Fuel Supply inputs describe the market share of various fuel blends. The KDHE analysis inputs are from the 2017 NEI submittal and are identical to the MDNR inputs, which reflect national defaults. The same market share inputs are used for both analysis years and do not change for the 2020 RVP scenario.

The Fuel Formulation inputs describe the chemical makeup of the fuel blends sold in the area. The 2017 Kansas NEI inputs were imported into MOVES but produced error messages due to the presence of "NULL" values in the input spreadsheet. A comparison to the MDNR inputs (also national defaults) showed that the "NULL" values were represented by zeroes in the default file. These values were corrected in the NEI file. The Fuel Formulation inputs contain the RVP values associated with

[7] *Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations*. May 2017. Available at https://www.epa.gov/sites/production/files/2017-07/documents/ei_guidance_may_2017_final_rev.pdf.

[8] The "truck" category includes MOVES type 30, 50, and 60 trucks.

the fuels; therefore, two different sets of 2020 inputs were needed, one reflecting the current RVP requirements and one reflecting the attainment area requirements. As specified by EPA in its April 2019 "Technical Information" document provided to the two states, MDNR used the MOVES model's "Fuel Wizard" to change the RVP values to reflect the proposed changes. Since the Kansas and Missouri counties are part of the same fuel region, the MDNR inputs (for both the existing and attainment area RVP scenarios) were used for the 2020 runs.[9]

The Fuel Usage Fraction inputs describe the percentage of time that E85 ("flex-fuel") vehicles are actually using E85 fuel (gasoline blended with 85% ethanol) as opposed to normal gasoline. MDNR used the MOVES defaults for this input, which reflect an E85 usage fraction of 5.3%. The Kansas 2017 NEI inputs use a lower value of 1.7%. After review, KDHE indicated that EPA had provided these values for the 2017 NEI, and that KDHE had accepted them. Thus, the NEI values (1.7% E85 usage) were used in the 2017 runs. The MDNR input files were used for the 2020 scenarios, but the fuel usage fractions were changed to reflect the Kansas NEI values.

Finally, the AVFT inputs describe the makeup of the vehicle fleet in terms of engine technology (i.e., for each vehicle type and model year, what fraction of vehicles have gasoline, diesel, compressed natural gas, flex-fuel, or electric drivetrains). The Kansas 2017 NEI AVFT inputs were reviewed, and it was found that the E85 fractions in the vehicle fleet were lower for most model years, and higher for some model years. Again, KDHE indicated that EPA had provided these inputs. However, when imported into the MOVES input databases, these files produced error messages related to missing data for various vehicle types and model years. As a result, the MDNR inputs (MOVES defaults) were used. These inputs do not change by county, by calendar year, or as a result of the RVP revision, so the same inputs were used for each of the six model runs.

2.1.5 VMT Inputs: Annual VMT, and Month/Day/Hour VMT Fractions

MOVES can use VMT inputs in terms of Highway Performance Monitoring System (HPMS) class (five vehicle categories) or MOVES sourcetype (13 vehicle categories). Likewise, it can accept either annual VMT with monthly, daily, and hourly VMT fractions, or daily VMT with hourly VMT fractions. The 2017 Kansas NEI inputs were in terms of annual VMT by MOVES sourcetype. When these inputs were reviewed against Kansas DOT data,[10] it was found that the NEI annual VMT inputs (when converted to an annual average day) were somewhat lower than the average daily VMT reported by Kansas

[9] STI used the MOVES Fuel Wizard independently to change RVP values in order to verify that MDNR's inputs were correct. EPA's "Technical Information for Kansas City, KS-MO State Fuel Rule Revision" document specifies that in addition to changing the RVP value for the ethanol blends sold in the area, Kansas and Missouri should also change the RVP value for "E0," which is gasoline that does not contain ethanol. However, the Fuel Supply inputs indicate that no E0 is sold in the area, so changing the RVP value for this fuel would not have any effect (MOVES would ignore the change since this fuel is not included in the fuel supply). This value was not modified in either the MDNR analysis or the KDHE analysis.

[10] Kansas DOT report "Travel by County – 2017" at http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burTransPlan/prodinfo/Mileage_Travel/CountyDVMT2017.pdf.

DOT for the two counties. KDHE was consulted, and the Kansas DOT values were used to adjust and renormalize the NEI inputs for use in the calendar year 2017 modeling. The VMT inputs were also converted from a sourcetype to an HPMS-type basis (with total VMT remaining the same).[11] Table 3 documents the annual VMT inputs used for the analysis.

Table 3. Annual VMT inputs used for the MOVES analysis.

County	2017 Annual VMT	2020 Annual VMT
Johnson County	5,542,923,580	5,830,445,629
Wyandotte County	1,897,791,220	1,996,233,281
Total	7,440,714,800	7,826,678,910

As a further quality assurance check, the inputs for population by sourcetype and VMT by sourcetype were used to calculate VMT per vehicle per day. The resulting values were reviewed for reasonableness. While there are no "correct" values, any values that seem unreasonably high or low (e.g., passenger cars driving 2,000 miles per day, when the national average is approximately 35 miles per day) suggest that either the population or the VMT inputs are incorrect. No outliers were identified through this check.

Several options were available for calculating VMT growth rates and estimating 2020 VMT. In its analysis, MDNR used a growth rate of 1.7% per year (5.2% over three years). The Kansas DOT Facts and Trends reports[12] include traffic monitoring data for several Kansas City-area counting sites, and these were used to calculate Kansas-specific growth rates. Use of data from the last four November reports (which were the most recent available) results in a VMT growth rate of 2.6% over the three years from 2017 to 2020; use of the four most recent July reports would result in a VMT growth rate of 0.56% over those three years. STI presented these options to KDHE, who in turn consulted with transportation planners at the Mid-American Regional Council (MARC). While MARC's internal projections had produced estimated growth in the 2.3-2.7% range, they felt that use of the MDNR growth rate (5.2% over three years) would not only be more conservative, but would also allow for a direct comparison of emissions results between the two states. Thus, the MDNR growth factor was applied to the (corrected) Kansas 2017 NEI VMT for each county to produce 2020 VMT inputs.

The monthly VMT fractions input takes annual VMT by vehicle type and breaks it down by month. When the Kansas 2017 NEI inputs were imported into MOVES, they produced error messages

[11] The mapping between MOVES source types and HPMS vehicle types can be found in Table 2 of EPA's MOVES Guidance, available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100V7EY.pdf.
[12] http://www.ksdot.org/bureaus/burtransplan/prodinfo/factsandtrends.asp.

because the distributions did not sum to one (for some vehicle types, the 12 monthly fractions summed to slightly more than one, and for others they summed to slightly less than one). The NEI inputs were re-normalized to correct this issue and then used for all modeling scenarios (the monthly VMT fractions do not change by year). The 2017 NEI daily and hourly VMT fractions did not produce errors and were used in the 2017 and 2020 runs. Like the monthly VMT fractions, they do not change by year.

Using this combination of inputs, the July weekday VMT calculated by MOVES was considerably higher than the annual average daily VMT reported by KDOT (18,557,580 versus 15,186,092 miles per day in Johnson County in 2017). For comparison purposes, a second Johnson County 2017 run was done with the MOVES default monthly and daily VMT fractions (which MDNR used) in place of the NEI inputs. This run generated a VMT estimate of 17,552,096 miles per day, roughly 5.5% lower than the NEI input fractions produced. Compared to the input fractions used by MDNR, the Kansas NEI input fractions have the effect of assigning more of the annual VMT to the month of July, thereby making July emissions relatively higher in the Kansas counties than in the Missouri counties.

2.1.6 Road Type Distribution and Ramp Fraction

The MOVES road type distribution inputs describe what fraction of VMT (by vehicle type) occurs on each of the MOVES roadway types: rural restricted access, rural unrestricted access, urban restricted access, and urban unrestricted access.[13] The 2017 Kansas NEI inputs were used for the 2017 and 2020 runs (road type distributions do not change by calendar year).

As a quality assurance check, these inputs were compared to Kansas DOT VMT by roadway class data and found to be reasonably consistent. The relative fractions assigned to the MOVES freeway road types vary by less than 1%; the fraction assigned to non-freeway road types also varies by less than 1%, with the difference being that the NEI input fractions assign more of this travel to *rural* non-freeway roads, and the Kansas DOT fractions assign more to *urban* non-freeway roads. The NEI inputs break out road type fractions by vehicle type, but the Kansas DOT VMT data do not, so this urban-rural difference could not be investigated further.

A related input in MOVES is the ramp fraction, which describes the percentage of freeway (restricted access) travel that occurs on freeway ramps as opposed to the freeway mainline. The 2017 NEI used defaults, as did the MDNR analysis. MOVES will automatically use defaults if no alternative inputs are provided, and none were provided for this analysis.

[13] Restricted access roads are interstate highways and other limited access highways; unrestricted access roads represent all other roadways.

2.1.7 Average Speed Distribution

The MOVES speed inputs reflect the distribution of travel speeds by vehicle type, road type, and hour. The speed estimates used for the modeling are from the 2017 Kansas NEI submittal. The same speeds were used for both 2017 and 2020, although the speeds do differ by county. The MDNR analysis used MOVES default speeds; the Kansas NEI speed distribution reflects speeds that are approximately 3 mph slower than national defaults, which would tend to lead to higher emissions estimates.

2.1.8 Meteorology

The meteorology inputs used (temperature and humidity by hour) are identical to those used in the MDNR analysis. MDNR developed these inputs specifically for the RVP analysis using July 2017 data from four Kansas City-area monitoring sites. For consistency, the same inputs were used in the KDHE analysis, with only the county codes changed so that they could be imported into the input databases. The meteorology input data do not vary by county and are the same for all three modeling scenarios in each county.

2.2 Nonroad MOVES Runs

2.2.1 MOVES runspecs

The MOVES runspecs for developing nonroad emissions were based on the runspecs prepared by MDNR for the Missouri counties. They follow EPA's guidance for SIP-related MOVES analysis. There are three sets of runspecs for each county: (1) a 2017 base run; (2) a 2020 base run with the current RVP requirements in place; and (3) a 2020 run with the attainment area RVP requirements in place. The 2020 runspecs are identical, except for referencing different input databases with the different fuel requirements. As recommended by EPA,[14] each county was modeled separately.

MOVES was run at the National scale to produce nonroad emissions inventories. As in the MDNR analysis, a July weekday was modeled. The modeling for nonroad emissions included all MOVES nonroad equipment types and fuel types. Emissions of VOCs and NOx were modeled for all emissions processes.

Unique input and output databases were prepared for each run, using the input data described below. The MOVES Nonroad Data Importer was used to create the input databases. The inputs are the same for each county.

[14] https://www.epa.gov/moves/latest-information-installing-and-running-motor-vehicle-emission-simulator-moves#MOVES-error.

2.2.2 Fuels

When modeling nonroad emissions, only two fuel inputs are needed: fuel supply and fuel formulation. For the 2017 runs, MDNR used MOVES defaults (no data were imported), and the KDHE runs follow the same practice. For the 2020 base runs (current RVP), MDNR fuel supply formulation inputs were used (these are identical to national defaults and are the same for each county). The MDNR fuel formulation inputs reflecting the attainment area RVP standard were used for the 2020 RVP runs.

2.2.3 Meteorology

The meteorology inputs used (temperature and humidity by hour) are identical to those used in the onroad analysis. The input data do not vary by county and are the same for all three modeling scenarios in each county.

2.3 Data Processing

A total of six MOVES runs were conducted: one for each county (Johnson and Wyandotte) for the three modeling scenarios. Input data spreadsheets were prepared for each input, and these data were imported into a MOVES input database for each simulation. The MOVES Summary Reporter was used to extract the output, and a separate summary report was saved for each run. Microsoft Excel was used to convert the output from grams to U.S. tons and to prepare the data in this report.

3. Results

3.1 Quality Assurance of MOVES Outputs

Several quality assurance checks were performed to ensure that the MOVES results were reasonable, and to ensure there were no errors or omissions in the MOVES input databases. Once the MOVES runs were complete, each input data spreadsheet was rechecked against the MOVES input databases themselves to ensure that the correct data were imported for each run. Independently, a script was developed and executed to reconfirm that the input data spreadsheets and input databases were in agreement.

As a quality assurance check on the MOVES output, one scenario was re-run in MOVES at the National scale, where MOVES uses all national default inputs instead of local data. While it is expected that this run would produce different results, since it does not use local data, any results that are grossly different (i.e., orders of magnitude higher or lower) from those using local data suggest that something may be incorrect with the input data. No such difference was seen.

Finally, a higher-level review of the MOVES results was conducted to look for outliers and unexpected results. Two such cases were identified and are discussed below: (1) Johnson County's nonroad VOC emissions for 2020 with attainment area RVP requirements were higher than 2017 baseline emissions (see Section 3.2); and (2) emissions were lower than expected when compared to emissions from a similar analysis conducted by MDNR for Kansas City, Missouri, counties (see Section 3.3).

3.2 MOVES Results

Table 4 shows July weekday onroad and nonroad VOC and NO_x emissions from Johnson and Wyandotte Counties, in units of tons per day (TPD), that were modeled by MOVES for each scenario. Both VOC and NO_x emissions decline between 2017 and 2020 with the current RVP requirements. This projected decrease in emissions (-2.38 TPD, or -12.4% for VOC; -7.00 TPD, or -23.8% for NO_x) suggests that emissions decreases due to vehicle fleet turnover during this period were greater than any emission increases due to increased VMT. Fleet turnover occurs as older vehicles and equipment are replaced with newer vehicles and equipment that are subject to more stringent emission control standards.

Table 4. Summary of MOVES modeling results (tons per day). Data represent the sum of average July weekday onroad and nonroad emissions from Johnson and Wyandotte Counties.

	2017 Baseline (Current RVP Requirements)	2020 (Current RVP Requirements)	2020 (Attainment Area RVP Requirements)
NOx	29.42	22.42	22.49
VOC	19.26	16.88	17.25

Emissions in 2020 with the attainment area RVP requirements are lower than 2017 baseline emissions, as shown in Table 5. However, the modeled VOC and NO_x emissions in 2020 are slightly higher (by 0.37 TPD, or 2.2% for VOC; by 0.07 TPD, or 0.3% for NO_x) than 2020 emissions modeled with the existing RVP requirements. These results are consistent with findings from the MDNR analysis (see Section 3.3).

Table 5. Total change in modeled July weekday mobile source emissions between the 2017 baseline scenario and the 2020 scenario with the attainment area RVP requirements.

	NOx	VOC
Total change in emissions (TPD)	-6.93	-2.01
% difference in emissions	-23.6%	-10.4%

Table 6 provides detailed MOVES results by county and by source (onroad and nonroad). The modeled emission trends discussed above hold true for each county and source individually, with the exception of nonroad emissions in Johnson County, where 2020 VOC emissions with the attainment area RVP requirements (5.35 TPD) are higher than 2017 baseline emissions (5.31 TPD).

Table 6. Detailed MOVES modeling results for each county and source.

	NOx, Tons Per Day			VOC, Tons Per Day		
	2017 Baseline	2020 Current RVP	2020 Attainment Area RVP	2017 Baseline	2020 Current RVP	2020 Attainment Area RVP
Johnson Onroad	15.70	11.69	11.72	8.65	7.25	7.29
Johnson Nonroad	5.49	4.46	4.46	5.31	5.13	5.35
Wyandotte Onroad	7.41	5.59	5.63	4.31	3.58	3.64
Wyandotte Nonroad	0.82	0.68	0.68	0.99	0.92	0.97
Total	29.42	22.42	22.49	19.26	16.88	17.25

We reviewed the MOVES onroad and nonroad results for the counties modeled by MDNR, and like Wyandotte County, none of them showed a trend of higher emissions in 2020. One factor contributing to the higher outcome for Johnson County is that MOVES appears to be applying higher nonroad equipment growth rates in the Kansas counties compared to the Missouri counties. The MOVES "Population_by_Sector_and_SCC" post-processing script was run on the nonroad output databases for the Kansas and Missouri counties, and the growth in equipment population was compared. Table 7 shows the equipment population by county and year; the equipment population growth rate in the Kansas counties is nearly twice that of the Missouri counties. The specific reason for the higher growth rates in Kansas was not investigated, but it is clear that had the Missouri growth rates applied in all five counties, Johnson County would not have had higher emissions in the 2020 attainment area RVP scenario than in 2017.

Table 7. Nonroad equipment population and growth in MOVES.

County	2017 Equipment Population	2020 Equipment Population	Growth
Clay	83,360	84,347	
Jackson	320,261	323,667	
Platte	42,746	43,194	
Missouri Total	**446,366**	**451,208**	**1.08%**
Johnson	247,136	252,296	
Wyandotte	69,500	70,735	
Kansas Total	**316,636**	**323,031**	**2.02%**

3.3 Comparison to MDNR Results

Table 8 compares modeled inventories for the Kansas counties considered in this analysis, and Missouri counties considered in a similar analysis conducted by MDNR.[15] The overall trends are consistent between the two analyses. For both VOC and NO_x, emissions in 2020 with the attainment area RVP requirements are slightly higher than 2020 emissions with the current RVP requirements, but still lower than 2017 baseline emissions.

Table 8. Comparison of KDHE and MDNR MOVES modeling results.

	NOx, TPD			VOC, TPD		
	2017	2020	2020 Attainment Area RVP	2017	2020	2020 Attainment Area RVP
KDHE	29.42	22.42	22.49	19.26	16.88	17.25
MDNR	57.01	43.51	43.68	31.25	28.11	28.82

[15] The MDNR results are from the *Technical Support Document for the Rescission of 10 CSR 10-2.330 Control of Gasoline Reid Vapor Pressure*, available at https://apps5.mo.gov/proposed-rules/ecmView.action?rulemakingDocImgId=1585 (accessed 2/21/2020).

One notable outcome from this comparison is that the NO_x and VOC emissions in the Kansas counties are about half those of the Missouri counties, even though the Kansas county VMT and vehicle populations are only about 25% lower. To determine the cause of this difference, additional sensitivity testing was conducted with MOVES, using Johnson County inputs in Jackson County, Missouri. The Jackson County VMT and vehicle population were still used, as well as the inputs that are identical between the two counties. However, the sensitivity runs used the Johnson County VMT fractions and road type distribution, speeds, E85 fractions, and age distribution. The Johnson County inputs resulted in 10% higher VMT and 3 mph slower speeds in Jackson County, compared to the original inputs, both of which would tend to contribute to higher emissions. However, even though these inputs resulted in higher modeled VMT and slower speeds, emissions overall were still lower using the Kansas inputs compared to the MDNR inputs.

Additional sensitivity tests with individual MOVES inputs revealed that the difference in age distributions explains nearly all of this difference. MDNR's documentation for its MOVES inputs indicates that the age distributions were based on 2014 vehicle registration data, which is only a few years after vehicle sales had begun to recover from the 2008 recession. The Kansas age distribution is based on more recent 2017 data. As a result, MDNR's age distribution inputs represent a relatively older vehicle fleet (that is, with a lower proportion of recent model year vehicles) compared to the Kansas inputs. To give a specific example, 8-year-old and newer vehicles represent 50% of the Johnson County (KS) passenger car fleet inputs, but only 40% of the Jackson County (MO) passenger car fleet inputs. Since newer vehicles emit lower NOx and VOC, a fleet with higher proportion of new vehicles (i.e., Johnson County in Kansas) would result in lower emissions.

4. Conclusions

MOVES2014b was used to estimate VOC and NO_x emissions from onroad and off-road vehicles for Johnson and Wyandotte counties, Kansas. Three scenarios were modeled: (1) calendar year 2017, to represent a baseline year; (2) 2020 with the existing RVP requirement; and (3) 2020 with the attainment area RVP requirement. Input data were obtained from the 2017 Kansas NEI submittal, from MDNR's modeling for the Missouri counties in the Kansas City area, and from Kansas DOT.

The modeling found that emissions of both VOC and NO_x declined between 2017 and 2020 with the current RVP requirements in place. If the current RVP requirement is revoked in 2020, the emissions would be slightly higher than if current RVP requirements remain in place, but still lower than 2017 levels.

The MOVES default growth rates for nonroad equipment are higher in the Kansas counties than in the Missouri counties, which led to a slight increase in VOC emissions from nonroad sources in the 2020 attainment area RVP scenario for Johnson County relative to 2017 levels. Emissions from onroad sources were lower relative to total VMT and vehicle populations in the Kansas counties compared to Missouri, due mostly to the MDNR's use of older vehicle age data.

With revocation of the RVP requirements, emissions of VOC and NOx in Johnson and Wyandotte counties, Kansas, are expected to decline by 10.4% for VOC and 23.6% for NO_x between 2017 and 2020. Since ozone is formed from VOC and NO_x emissions, this result suggests that the proposed RVP revocation should not negatively affect ozone NAAQS attainment in the region. These results can be used as part of a technical support document to support a SIP revision for the state of Kansas. Additional documentation beyond the scope of this report is needed to support a SIP revision, such as presentation of ozone monitoring data trends and a discussion of the potential effects of the RVP revision on pollutants other than ozone.