State of Nebraska
Exceptional Event Demonstration Package
April 11, 2015
In support of the 2015 Ozone NAAQS

Nebraska Department of Environment Quality
Air Quality Division

August 23, 2016

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Acknowledgments

The Nebraska Department of Environmental Quality would like to thank the Kansas Department of Health and Environment (KDHE) for their assistance in providing data and information for this demonstration package.

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1. Overview

Eastern Nebraska contains two large metropolitan areas: Lincoln and Omaha. In April 2015, eastern Nebraska was impacted from numerous fires in the Flint Hills region of Kansas and parts of Oklahoma. Both cities experienced poor air quality days during this time period, especially on April 11, 2015, when burning in the Flint Hills was particularly extensive.

On April 11, 2015, smoke was transported northward into Nebraska from prescribed burning in Kansas and Oklahoma, contributing to ozone formation and an exceedance of the NAAQS for 8-hour ozone at air quality monitors in the Omaha area. Monitor locations and ozone concentrations are noted in Table 1.1. (Source: AQS)

The purpose of this report is to provide evidence that the daily peak 8-hour average ozone concentrations, in exceedance of the NAAQS on April 11, 2015, were the result of smoke generated by fires in areas upwind of the monitors where the exceedances occurred. The 2015 NAAQS for 8-hour ozone concentration is 0.070 parts per million (ppm). This document demonstrates that the 8-hour ozone concentrations above 0.070 ppm meet the requirements for having been influenced by an exceptional event as stated in the U.S. Environmental Protection Agency's (EPA) Exceptional Events Rule (72 FR 13560, March 22, 2007).

Table 1-1: Nebraska Monitors with 8-hour Ozone Concentrations Exceeding 0.070 ppm on April 11, 2015

Monitor	Location	Ozone (ppm)
NCore	4102 Woolworth Street, Omaha, NE	0.076
South Omaha	2411 "O" Street, Omaha, NE	0.071
Whitmore	1616 Whitmore Street, Omaha, NE	0.077

Locations of air quality monitors (for ozone) currently in operation in and near Nebraska are shown below (Figure 1a).

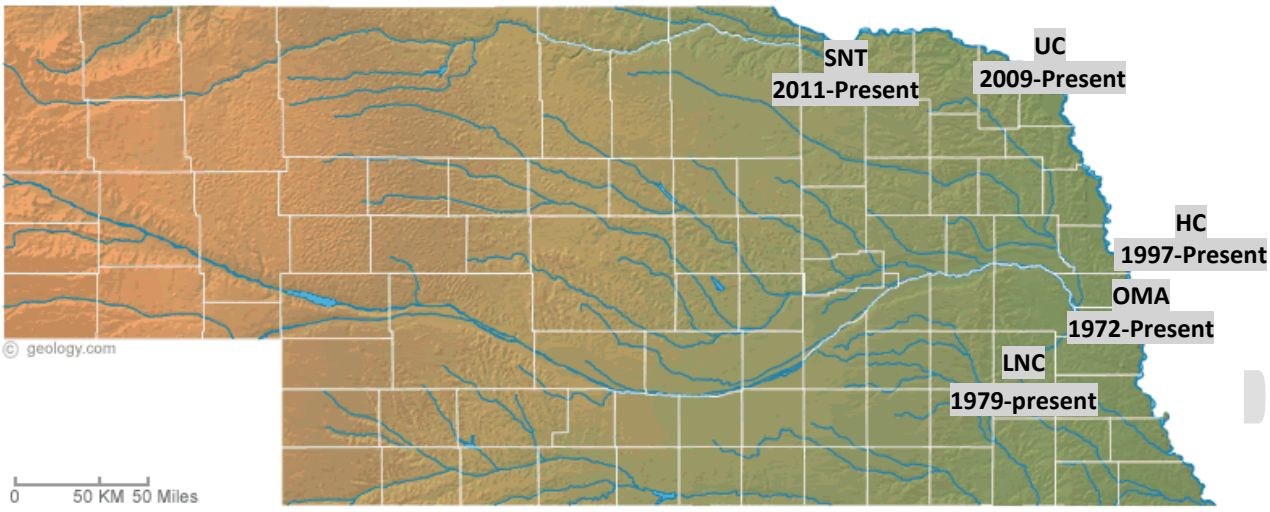

Figure 1a: Ozone Air Quality Monitors in/near Nebraska*

*Legend: The table below explains the 2-3 letter abbreviations shown on the map. Below the abbreviations are the years in during which sites were operational at these locations.

Abbr.	Location	Operator [a]	Years Sampled	# of Years	Annual 4th High Range, 2013-2015 (ppb) [b]
SNT	Santee Indian Reservation	EPA	2011-present	4+	63 - 75
Omaha MSA Sites					
HC	Harrison County, IA	IA DNR	1997 - present	18+	59 - 80
OMA	30th & Fort Streets, Omaha	DCHD	1972-1977	5	56 - 96
			1981-2014[b]	24	47 - 80
	2411 "O" Street, Omaha	DCHD	1975-present	40+	37 - 96
	4102 Woolworth Street, Omaha	DCHD	2011-present	4+	63-71
	1616 Whitmore Street, Omaha	DCHD	2015[c]	(c)	(b)
Lincoln MSA Sites					
LNC	1st & Maple Streets, Davey	LLCHD	1985-present	30+	49 - 69
Sioux City MSA					
UC	31986 475th Ave, Union Co, SD	SD DENR	2013-present	2+	62 - 63

Footnotes:

(a) Agency abbreviations:
EPA – US Environmental Protection Agency
LLCHD – Lincoln Lancaster County Health Dept.
SD DENR – SD Dept. of Environment & Natural Resources
DCHD – Douglas County Health Department
IA DNR – Iowa Dept. of Natural Resources
NDEQ – NE Dept. of Environmental Quality
NPS – National Park Service

(b) The range of annual 4th high values was determined from historical data thru 2014. Data from 2015 was not included in the range.

(c) The Omaha 30th & Fort site was temporarily closed for 2015 due to construction activity at the site and relocated to 16th & Whitmore (existing SO_2 site). A decision to retain the site at 16th & Whitmore or move it back to 30th & Fort will be made following the 2015 monitoring year.

Locations of the air quality monitors showing ozone exceedances on April 11, 2015 are shown below (Figure 1b).

Figure 1b: Air Quality Monitors Showing Ozone Exceedance on April 11, 2015

Nebraska's current air monitoring network is summarized in Table 1-2.

Table 1-2: Nebraska's Air Quality Monitoring Network

Table III-1: Nebraska Air Monitoring Network on March 31, 2016. [1]					
Pollutant	DCHD Omaha MSA [2][4]	NDEQ Cass County	LLCHD Lincoln MSA [5]	NDEQ Other Areas of NE [6]	Total Analytical Sites [4]
Ozone	3 [5]	0	1 [5]	0	4 [5]
Carbon Monoxide	2 [5]	0	0	0	2 [5]
Nitrogen Oxides	1 [5]	0	0	0	1 [5]
Sulfur Dioxide	2 [5]	0	0	0	2 [5]
PM_{10}	4 [5]	2	0	0 [7]	6 [5]
$PM_{2.5}$	4 [5]	0	1	2	7 [5]
$PM_{10-2.5}$	1 [5]	0	0	0	1 [5]
$PM_{2.5}$ Speciation	1 [5]	0	0	0	1 [5]
Lead	1 [5]	0	0	2	3 [5]
NCore [4]	1	0	0	0	1

Table 1-2: Nebraska's Air Quality Monitoring Network

Table III-1: Nebraska Air Monitoring Network on March 31, 2016. [1]					
IMPROVE [6]	0	0	0	1	1
Total Reduced Sulfur [8]	0	0	0	1[8]	1
Totals Sites [4]	9 [4]	2	2 [5]	6	19 [4]

Footnotes:

(1) This table summarizes the number of operating sites in the NE SLAMS network as of 3/1/16.

(2) The Omaha MSA encompasses 5 NE counties: Cass, Douglas, Sarpy, Saunders & Washington. DCHD operates sites in Douglas, Sarpy & Washington. NDEQ operates sites in Cass County

(3) Cass County has limestone mining and processing facilities, which are subject to the Cass County specific air emission controls set forth in Chapter 21 of the NDEQ Title 129.

(4) There were 3 multi-pollutant monitoring sites in the Omaha MSA in 2015: 1616 Whitmore – SO_2 & Ozone; 24th & O Sts (South Omaha) : Ozone and a PM_{10} ; and NCore (42nd & Woolworth) - CO, NO/NOy, O_3, SO_2, PM, lead and meteorological
Thus there are 9 monitoring sites within the Omaha MSA. Three of those sites are multi-pollutant sites: NCore (9 pollutants), Whitmore (2 pollutants) and South Omaha (2 pollutants). Thus when the pollutants are counted separately there are 19 analytical sites. Similarly, there are19 monitoring sites in NE (sum of "Total Sites" row), and 28 analytical sites (sum of "Total Analytical Sites" column).

(5) This footnote means that one (1) monitor in this category is located at the NCore site.

(6) IMPROVE – Interagency Monitoring of Protected Visual Environments. These are fine particulate and particulate speciation monitors intended to provide information for studying regional haze that may impact Class I National Park and Wilderness Areas. IMPROVE sites are not SLAMS. EPA is responsible for the design of the IMPROVE network. Changes to the IMPROVE Network within Nebraska do not need to be included in Nebraska's annual network plan, but the existence of the sites are recognized within the network plans.
The NDEQ has provided administrative support (with EPA funding) for two IMPROVE sites: one at the Nebraska National Forest near Halsey, NE, and the other at the Crescent Lake National Wildlife Refuge. EPA made the determination to close Crescent Lake National Wildlife Refuge site at the end of CY2015. Thus, there is one remaining IMPROVE site that is administered through the NDEQ; the Nebraska National Forest site near Halsey, NE

(7) The NDEQ operated PM_{10} monitoring sites in Cozad and Gothenburg, which were closed 3/8/16 in accordance with the 2015 Network Plan.

(8) The NDEQ has one total reduced sulfur (TRS) site in Dakota City, which is scheduled for closure in mid-2016 in accordance with the 2015 Network Plan.

Source: 2016 Ambient Air Monitoring Network Plan

Tables 1-3 through 1-5 show detailed information on the monitoring site locations and monitoring objectives for the three monitors that showed an exceedance for ozone on April 11, 2015. This information is contained in the 2016 Draft Ambient Air Monitoring Network Plan.

Table 1-3: Omaha NCore Monitoring Site	
Site Name: Omaha NCore [1]	AIRS ID: 31-055-0019 [1]
Location: 4102 Woolworth St., Omaha	Latitude: 41.246792º Longitude: -95.973964º
Operating Agency: Douglas County Health Department	
Purpose: NCore	Scale: Neighborhood
Monitor/Pollutant: Ozone (O_3)	

Type/POC: Primary / POC 001	Monitoring Frequency: Continuous
Analyzer/Sampler: Thermo 49i	EPA Method: EQOA-0880-047
Start-Up Date: 4/1/11	Closure Date: Currently operating
Data used for NAAQS comparison: Yes Meets applicable provisions of 40 CFR Part 58 Appendixes A thru E: Yes, App B not applicable	
Other pollutants monitored include: CO, NO/NO_x, SO_2, $PM_{2.5}$, PM_{10}, Pb, Atmospheric radiation and meteorological parameters	

Table 1-4: South Omaha Monitoring Site		
Site Name: South Omaha – Ozone	AIRS ID: 31-055-0028	
Location: 2411 O Street, Omaha	Latitude: 41.207500º	Longitude: -95.947500º
Operating Agency: Douglas County Health Department		
Monitor Information	**Pollutant: Ozone (O_3)**	
Type/POC: Primary / POC 001	Monitoring Frequency: Continuous	
Analyzer/Sampler: Thermo 49C	EPA Method: EQOA-0880-047	
Purpose: Population Oriented	Scale: Neighborhood	
Start-Up Date: 7/1/78	Closure Date: Currently operating	
Data used for NAAQS comparison: Yes Meets applicable provisions of 40 CFR Part 58 Appendixes A thru E: Yes, App B not applicable		
Other pollutants monitored: PM_{10}		

Table 1-5: Whitmore Monitoring Site		
Site Name: Whitmore – Omaha	AIRS ID: 31-055-0053	
Location: 1616 Whitmore St, Omaha (1)	Latitude: 41.3225º	Longitude: -95.9383º
Operating Agency: Douglas County Health Department		
Monitor Information	**Pollutant: Ozone (O_3)** (2)	
Type/POC: Primary / POC 001	Monitoring Frequency: Continuous	
Analyzer/Sampler: Thermo 49C	EPA Method: EQOA-0880-047	
Purpose: Population Oriented (1)	Scale: Neighborhood (1)	
Start-Up Date: 4/1/15	Closure Date: Currently operating	
Data used for NAAQS comparison: Yes Meets applicable provisions of 40 CFR Part 58 Appendixes A thru E: Yes, App B not applicable		
Other pollutants monitored: SO_2		
Comments: (1) This site is in a socioeconomically disadvantaged area. (2) The ozone monitor from the 30th & Fort Street site was re-located to this site in 2015 & 2016 due to demolition/construction activities.		

A. Exceptional Event Definition and Demonstration Criteria

An Exceptional Event is defined in 40 CFR §50.1(j) as an event that:

- affects air quality;
- is not reasonably controllable or preventable; and

- is caused by human activity that is unlikely to recur at a particular location or is a natural event, and
- is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event.

As specified in 40 CFR 50.14(c)(3)(iv), to justify the exclusion of air quality data from NAAQS determination, the State must demonstrate the following:

1. The event satisfies the criteria set forth in 40 CFR §50.1(j), as described above;
2. There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;
3. The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and
4. There would have been no exceedance or violation but for the event.

40 CFR Part 50.14(b)(3) grants EPA the authority to exclude data from use in determination of exceedances and NAAQS violations, provided that:

- the State satisfactorily demonstrates that emissions from prescribed fires caused a specific concentration exceeding one or more NAAQS at a particular air quality monitoring location;
- the State satisfactorily demonstrates that the event meets the requirements of 40 CFR Part 50.1(j); and
- the State has ensured that the burner has employed basic smoke management practices.
  - As stated in the Exceptional Events Rule, "Consistent with historical practice governed by guidance contained in the Interim Air Quality Policy on Wildland and Prescribed Fires…, EPA approval of exceedances linked to a prescribed fire used for resource management purpose is contingent on the State to certify that it has adopted and is implementing a Smoke Management Program (SMP) as described in that policy."

Kansas, the state in which prescribed burning was conducted, does have an SMP[1] in place, as well as air regulations that address prescribed burning.

The SMP should address the following elements, which are further described in Section B:

- Notification
- Education
- Dispersion
- Mitigation

B. Flint Hills Smoke Management Plan

[1] The Flint Hills Smoke Management Plan is available at:
http://www.ksfire.org/docs/about/Flint_Hills_SMP_v10FINAL.pdf

The Kansas Department of Health and Environment (KDHE), with the assistance of numerous stakeholders, developed the Kansas Flint Hills SMP; it was formally adopted by KDHE in December of 2010.

The SMP addresses the following:

- history and background of prescribed burning in the Flint Hills
- the Flint Hills ecosystem
- reasons for having an SMP
- fire management practices
- air quality and other considerations when deciding whether or not to burn
- reducing downwind impacts of burning
- burning restrictions
- outreach, education and public notification
- surveillance and enforcement
- data collection, research and long-term strategies
- SMP evaluation and contingency measures
- air monitoring locations in Kansas
- meteorological conditions for smoke dispersion
- current state regulations

Key items of note include:

1. Notification

KDHE annually issues a general Air Quality Advisory to the public in March prior to the start of Flint Hills burning. This advisory addresses the reasons for burning and potential health effects of the smoke from these fires. KDHE also monitors burning conditions in March and April and issues air quality and health advisories for days that may be impacted by smoke produced from prescribed burning fires. Likewise, private land managers are required by their county or voluntarily notify their local authorities prior to burning of the location where burning will take place. Nine counties participated in a pilot program in which land managers notified their local agency and reported when and how many acres they planned to burn that day, followed by a later call in which they reported the actual number of acres burned.

2. Education

Materials and resources available on the www.ksfire.org website - hosted by Kansas State University (KSU) Extension - include handouts, booklets, tools, maps, as well as links to additional resources and training schedules. The KSU Agricultural Extension Service and others take measures to ensure the fire management practices (FMPs) are followed through education and outreach efforts to farmers and ranchers who conduct prescribed burning. The advisories issued by KDHE also provide information and education to the public.

3. Dispersion

FMPs are addressed in the SMP and a modeling tool is available on the www.ksfire.org website for use by land managers. This tool allows them to predict downwind impacts of prescribed fire and make informed decisions about whether or not burning should proceed as planned. In

addition, the plan contains basic questions to consider and a checklist for land managers to use when making their determination as to whether or not burning is appropriate.

4. Mitigation

KDHE addressed evaluation activities undertaken by the SMP subcommittee following the 2011 burn season. The committee identified the need for improvements to many areas of the plan, and prioritized them for the 2012 burn season. Tasks and activities identified are listed below and KDHE states that many of these were implemented before the 2012 burn season commenced.

- education and outreach to stakeholders (such as county commissioners, emergency management staff, park managers, and producers)
- improvements and updates to education materials and notification methods
- improvements of mapping and other tools in predicting downwind impacts of prescribed burning
- post-burn season reports, surveys, meetings and outreach
- potential contingency activities, to include additional burning restrictions or bans, and smoke plans; requirements for notification, data collection, burn approvals/permits

C. Summary of Approach

A number of methods were used to develop a weight of evidence demonstrating that the 8-hour ozone concentrations above 0.070 ppm on April 11, 2015 meet the rules for data exclusion as Exceptional Events. In summary, meteorological data, ambient air pollutant data, and fire/smoke maps were used to assess whether conditions were favorable for transport of smoke from the fires to the monitors that showed 8-hour ozone concentrations above 0.070 ppm.

The 8-hour ozone concentrations on April 11, 2015 were compared to concentrations historically observed during the month of April to assess whether the 8-hour ozone concentrations above the NAAQS on April 11, 2015 were historically unusual. Two analyses were used to investigate whether the 8-hour ozone concentrations above 0.070 ppm would have occurred but for the smoke: (1) analysis of ozone concentrations on days with similar meteorological conditions but without smoke impacts, and (2) analysis of ozone concentrations on days with higher temperatures and no smoke impacts. The estimated ozone contribution due to fires was calculated analysis (1) by averaging ozone concentrations for days without smoke impact and subtracting those values from observed 8-hour concentrations on the event date. If the result of that subtraction was less than 0.071 ppm, the analysis demonstrates that the observed 8-hour ozone concentration in exceedance of the NAAQS would not have occurred.

D. Summary of Findings

This report demonstrates that:

- the smoke events in question were not reasonably preventable/unlikely to recur (Section 3);
- there was a clear causal relationship between the fires and the 8-hour ozone exceedances (Section 4);
- ozone concentrations during the event were in excess of historical norms (Section 5); and
- ozone exceedances would not have occurred but for the smoke from the fires (Section 6).

Thus, the findings strongly suggest that all of the 8-hour ozone concentrations above 0.070 ppm in Nebraska on April 11, 2015 meet the rules for exclusion as Exceptional Events. A brief synopsis of the meteorological and air quality conditions on this date is presented below.

April 11, 2015 Event

NDEQ was notified on Friday, April 10, 2015, via email from KDHE meteorologist Douglas Watson that there was potential for significant burning on both April 10 and 11, 2015. He also noted that the meteorological models were predicting a later wind shift (from westerly to southerly) on April 10, and that the smoke model was predicting impacts in eastern Nebraska from Flint Hills burning on Saturday April 11, 2015 and through the next morning. He stated that there would almost certainly be smoke impacts in Nebraska due to burning on Saturday, even if smoke did not reach Lincoln and Omaha until Saturday evening or early Sunday morning. Due to strong south-southwest winds at 10-20mph (with gusts near 30 mph) expected for the weekend (April 11-12, 2015), he stated that if burning occurred it was expected that smoke would be transported northward into Nebraska.

On April 11, 2015, approximately 45,000[2] acres were burning in the Flint Hills of Kansas. Winds were from the south, steady at about 20 mph, with gusts up to almost 35 mph in the afternoon. The high temperature was 74 degrees. Winds transported smoke from fires in the Flint Hills into Nebraska and resulted in ozone exceedances at the Omaha monitors. Figures 1c through 1e show the locations of active fires in the Flint Hills and smoke plumes across the area for April 10 and 11, 2015.

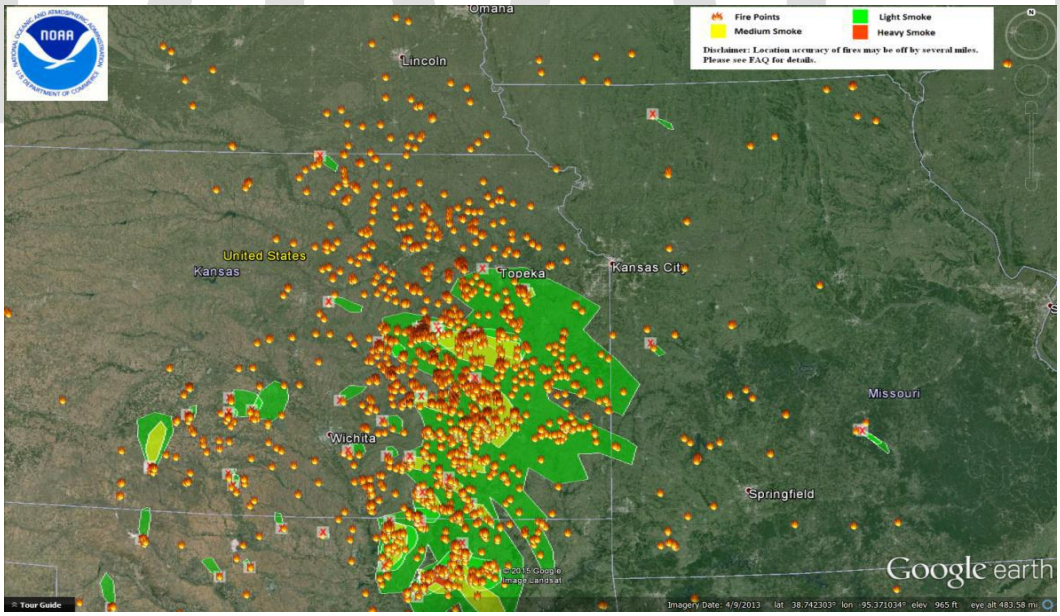

Figure 1c: NOAA Map of Fire Locations and Smoke Plumes in Eastern Kansas on April 10, 2015. (Source: Kansas Flint Hills 2015 Update, August 18,

[2] This estimate was calculated using the burn acreage estimates given in the KDHE MARC Air Quality Forum Meeting presentation (Kansas City, MO, April 14, 2015) and the Flint Hills Prescribed Fire Update presentation (for the week of April 10-17, 2015).

Matching day analysis provides evidence that, without the impact from fires, no 8-hour ozone concentrations above 0.070 ppm would have occurred at the Omaha NCore, South Omaha, or Whitmore monitors on April 11 (see sections 5 and 6). In addition, because no other unusual emissions were identified on this day and because the estimated concentrations without the fires were well below the NAAQS, it is very unlikely that other sources of ozone would have caused this exceedance.

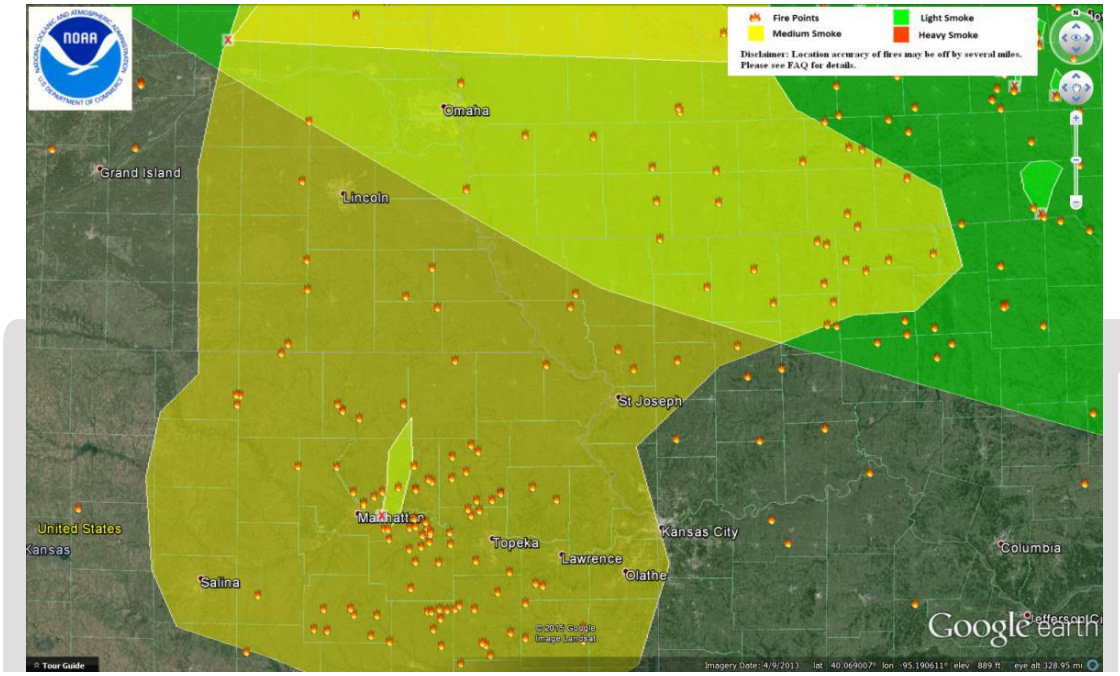

Figure 1d: NOAA Map of Fire Locations and Smoke Plumes in Northeast Kansas and Southeast Nebraska on April 11, 2015. (Source: Kansas Flint Hills 2015 Update, August 18, 2015, KDHE)

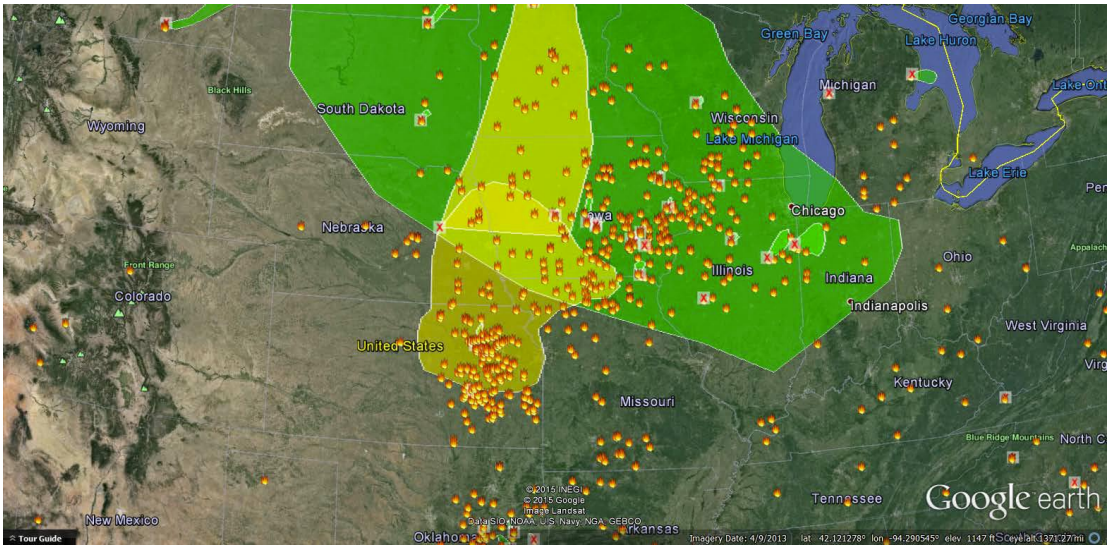

Figure 1e: NOAA Map of Fire Locations and Smoke Plumes in the Upper Midwest on April 11, 2015. (Source: Kansas Flint Hills 2015 Update, August 18, 2015, KDHE)

2. Data Acquisition

Ozone concentrations in excess of the NAAQS normally occur with sunny skies, warm air temperatures, stable atmospheric conditions, and light winds. Ozone concentrations may also increase in the presence of unusual emissions of ozone precursors such as volatile organic compounds (VOCs) and nitrogen oxides (NO_x), of which wildland fires are known sources. To analyze the specific conditions on April 11, 2015, when 8-hour ozone NAAQS were exceeded, fire and smoke, air quality, and meteorological data were first collected from a variety of sources chosen for their high standards for data quality. Sources are noted when applicable. Below is a description as to why these data are necessary to understand and explain the processes that influence ozone conditions.

- Fire locations and concentration: Locations of fires, the number of fires burning, and their proximity to air quality monitors were assessed to determine if a causal relationship existed. Concentrated biomass burning with favorable meteorological conditions enhances the potential for elevated ozone concentrations.

- Smoke plumes: Smoke plumes were assessed to determine impact on the air quality monitors in Nebraska. Smoke plumes have the potential to impact ozone concentrations, given the proper meteorological conditions of light winds and warmer temperatures.

- Historical norms: Normal values compiled from 2011-2016 were used for comparison with the event date to determine if the ozone concentrations recorded were abnormally high.

- Temperature: Surface temperature data were assessed to determine whether temperatures were conducive to elevated ozone levels. Warmer temperatures enhance ozone formation.

- Surface wind speeds: Surface wind data were used to assess pollutant dispersion. Light winds minimize dispersion and limited pollutant dispersion normally results in higher ozone levels.

- Wind direction: Wind direction was assessed to determine transport of pollutants. Air parcels originating or passing through areas with higher pollution levels (such as smoke) indicate potential transport of pollutants to downwind locations.

3. Not Reasonably Preventable/Unlikely to Recur

A. Lack of State Control Over Prescribed Burning in Kansas

Current regulations in place that address burning within the state of Kansas contain exemptions for prescribed burning. The Kansas Flint Hills SMP relies on voluntary adherence by land managers and ranchers and there is currently no mechanism in place to verify that those responsible for burning (land managers and ranchers) are following the burn management practices in the SMP. KDHE does not have procedures in place to follow up with land managers to track how many of them utilized the modeling tool available on the Flint Hills

Smoke Management webpage before deciding to burn, or whether the land managers consult the SMP prior to burning.

There are numerous resources available to land managers and ranchers on the Flint Hills Smoke Management website, and at least one local radio station provides a daily smoke report advising on favorable and non-favorable days to burn. However, because the program is entirely voluntary, there is no way for the states of Kansas or Nebraska (or any other states) to exercise control over prescribed burning. Nebraska, as a downwind state, has no input into prescribed burning activities and has only the ability to react to air quality conditions that result from the Flint Hills fires and issue air quality advisories as conditions dictate.

NDEQ met with KDHE in late June 2016 to discuss issues with respect to prescribed burning and the impacts on Nebraska. Another meeting is planned for the fall of 2016 to continue the discussions and propose potential improvements to reduce impacts on Nebraska.

B. Flint Hills Area

The Flint Hills in eastern Kansas (Figure 3a) and northeastern Oklahoma[3] are an extensive, landscape expression that contains about 7.3 million acres of tallgrass prairie. Tallgrass prairies once covered much of the American heartland, and only about 4% remains. The Flint Hills landscape remains as the continent's last significant and contiguous expanse of tallgrass prairie. Roughly two-thirds of all tallgrass prairie in North America is contained in the Flint Hills.[4]

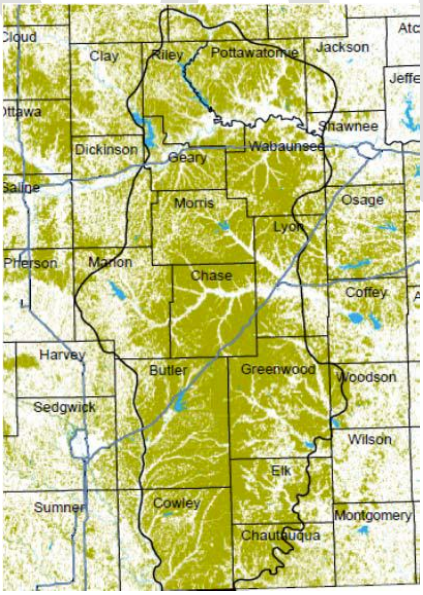

Figure 3a: Kansas Flint Hills Area (outlined in black).
Source: 2004 Statewide United States Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP).

[3] The Osage Hills (in Osage County, Oklahoma) represent a southern extension of the Greater Flint Hills landscape
[4] Kansas Department of Environmental Health (KDHE), State of Kansas Exceptional Event Demonstration Package, November 27, 2012

C. Unlikely to Recur

This evaluation demonstrates that the likelihood of prescribed fire recurrence is within the range of the natural fire-return interval established historically for the tall grass prairie ecosystem and thus meets the ''unlikely to recur at a particular location'' requirement of the statutory language.

Since Euro-American settlement, fire has largely been suppressed in the North American grasslands, contributing to range degradation due to woody encroachment. An exception to this is the extensive use of fire as a management tool by ranchers in the Flint Hills of Kansas and Osage Hills of Oklahoma. Residents in these areas typically view fire as a necessary rangeland practice, whereas outside the region, the general attitude toward fire is often less favorable. Cattlemen recognized early on that burning the Flint Hills pastures improved the condition of their pastures and cattle weight gains.[4]

In the years following settlement, a significant portion of the Flint Hills was frequently burned despite the academic warnings against the practice, particularly in large pastures grazed by transient cattle. In the 1970s, range scientists began to promote the agricultural and ecological benefits of burning tallgrass prairie. Today, range burning is widely prescribed by range specialists and ecologists alike as a management tool necessary to maintain the ecological integrity of tallgrass prairie. However, the cyclic scheduling of burns varies according to the objective of management practices.[4]

Historically, humid tallgrass prairies are thought to have burned primarily during the dormant season, particularly in autumn by Native Americans, but lightning-caused fires were more common in mid- to late summer. Contemporary pasture burning in the Flint Hills generally occurs in late March through early May, but early ranchers in the Flint Hills often burned even earlier to stimulate "green-up." Towne and Owensby (1984) reported that burning of un-grazed prairie in late spring increased grass production and favored desirable warm season grasses, whereas winter and early- and mid-spring burns favored forbs and sedges.[4]

Although there is a perception that most of the Flint Hills are intensively grazed and burned each year, satellite imagery and Kansas Agriculture Statistics suggest these practices do not extend across the entire landscape. [4] An analysis of satellite imagery from 2000 through 2016 indicates that about 2.1 million acres are burned on average (a range of 0.7 to 3.2 million acres) within the Flint Hills of Kansas and Oklahoma (Table 3-1). This translates to 29% of total prairie acres burned annually, based on a 7.296 million acreage estimate (11,400 square miles)[5] within the Flint Hills tall grassland. The annual acres of grassland burned across the Flint Hills, by county, are shown in Figure 3b. Figures 3b and 3c show annual acres burned and annual percentage of acres burned, respectively. It should be noted that the grasslands that are burnt annually extend into three counties of Oklahoma and several peripheral counties surrounding these core counties. Significant burning can and does occur in these counties, especially the three counties of Oklahoma (Osage, Nowata, and Washington).

[5] Size of Ecoregion, World Wildlife Federation

Table 3-1: Flint Hills Prescribed Acreage Burned (2000-2016)
Source: KDHE, 2016 Kansas Flint Hills Update – June 30, 2016

Flint Hills Prescribed Fire Acreage Burned by Year

County	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Butler	297,653	177,390	74,487	259,012	126,162	309,962	91,182	121,838	268,031	293,761	241,189	213,883	45,004	13,097	166,442	94,349	245,921
Chase	318,718	184,340	168,541	278,487	186,857	340,772	197,467	54,425	286,610	310,487	280,124	255,240	28,912	5,174	288,529	218,860	318,679
Chautauqua	91,506	47,660	26,857	123,460	75,120	115,197	65,112	21,575	85,390	123,043	38,919	79,226	12,819	3,985	113,499	71,321	94,473
Coffey	68,649	28,216	94,996	88,525	41,683	112,402	101,081	61,282	75,460	122,857	42,255	77,612	26,162	11,166	77,298	81,978	76,450
Cowley	171,614	110,842	21,915	199,444	112,834	194,162	63,737	65,021	189,128	149,128	127,212	134,002	18,193	3,907	92,804	61,036	158,984
Elk	128,927	114,857	58,564	157,514	105,050	159,537	66,595	60,341	148,062	177,807	126,718	124,363	35,027	8,680	167,647	92,990	171,757
Geary	46,332	41,359	30,116	30,487	44,355	103,444	59,166	23,104	68,185	75,846	61,915	56,120	52,418	6,039	47,769	15,583	51,492
Greenwood	302,487	150,888	178,487	333,823	152,278	356,278	182,703	137,252	307,182	353,745	271,861	258,973	29,993	18,873	250,042	247,741	284,624
Lyon	165,282	84,371	144,402	188,865	104,016	214,286	221,128	61,838	158,610	203,382	121,699	160,604	43,336	14,471	143,075	156,975	174,213
Marion	64,958	26,317	12,000	53,931	26,672	80,896	15,985	10,378	52,788	62,131	60,649	45,632	8,324	3,228	44,402	28,124	75,647
Morris	134,363	76,880	81,050	106,734	68,757	171,599	138,054	18,533	125,205	111,938	126,595	114,117	16,155	2,162	107,600	64,433	149,780
Osage (KS)	92,030	63,692	46,933	93,107	60,315	114,361	65,419	33,152	92,782	104,903	78,559	81,210	42,657	10,008	77,901	66,070	64,974
Pottawatomie	107,660	131,645	70,471	42,224	103,629	169,884	92,803	58,502	124,247	126,178	119,784	108,853	124,480	5,961	120,882	63,229	89,114
Riley	90,749	77,714	71,413	63,073	71,073	128,046	97,143	70,457	92,479	116,510	86,703	89,490	85,561	36,201	84,032	50,039	64,110
Wabaunsee	195,444	128,741	136,664	173,591	157,359	281,467	273,684	91,723	240,880	261,838	183,521	203,319	64,047	23,552	240,173	102,349	199,804
Wilson	50,605	35,022	25,807	51,197	33,166	62,884	35,972	10,969	51,019	57,684	43,198	44,655	7,985	8,417	33,236	22,688	23,136
Woodson	73,838	73,266	48,386	85,375	62,100	99,043	52,664	54,981	86,301	97,622	59,954	73,855	19,599	12,124	82,271	82,596	79,276
Nowata (OK)	48,162	33,332	24,562	48,726	31,565	59,849	34,236	18,355	48,556	54,900	41,113	42,500	4,880	4,834	68,217	64,773	48,186
Osage (OK)	303,691	318,518	88,139	407,321	241,066	346,533	102,595	78,579	274,255	333,962	237,792	265,387	36,155	22,147	275,278	206,504	301,258
Washington (OK)	50,295	34,808	25,649	50,884	32,963	62,499	35,752	14,504	50,706	57,331	42,933	44,382	4,309	3,351	48,371	45,669	32,387
Kay (OK)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	32,711	32,526
	2,802,963	***1,939,859***	***1,429,438***	***2,835,778***	***1,837,021***	***3,483,101***	***1,992,477***	***1,066,809***	***2,825,876***	***3,195,053***	***2,392,693***	***2,473,423***	***706,016***	***217,377***	***2,529,468***	***1,870,018***	***2,736,791***

No burn scar data available; Estimated based on year's overall average burn rate multiplied by county's grassland acreage

Average Acres Burned 2000-2016
2,137,304

Average Acres Burned 2000-2016 w/o 2012-2013 drought years
2,360,718

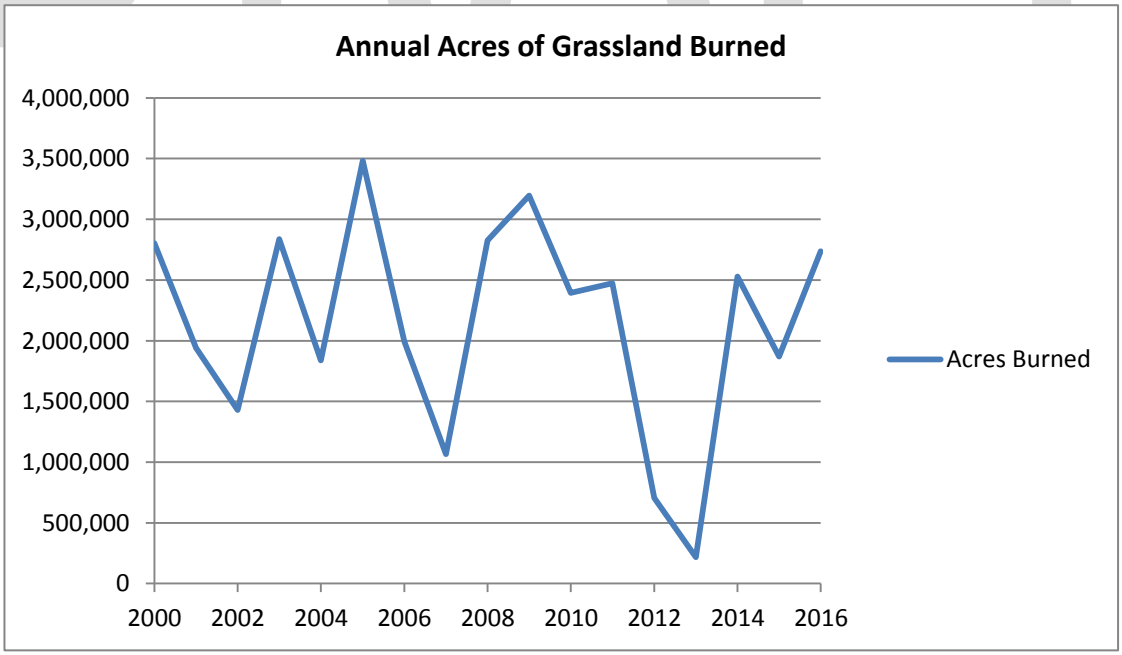

Figure 3b: Annual Acres Burned, 2000-2016
Source: KDHE, 2016 Kansas Flint Hills Update - Jun 30, 2016

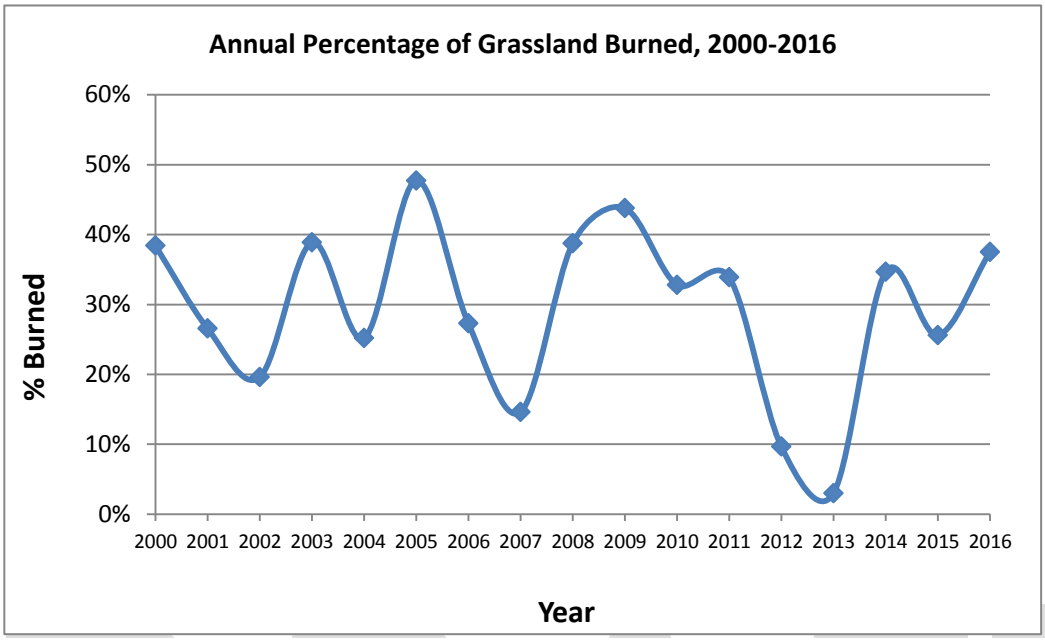

Figure 3c: Annual Percentage of Acres Burned, 2000-2016
Source: KDHE, 2016 Kansas Flint Hills Update - Jun 30, 2016

In addition, satellite imagery also revealed that certain areas of the Flint Hills, particularly the more intact areas of the landscape, were burned on a more frequent basis. However, even those areas identified as “dark red” in Figure 3d, which were burned every year over the 17-year period of 2000-2016, only made up a very small percentage of the total number of burnable acres in the Flint Hills. The majority of acres were either not burned (40.6%) or only burned three or fewer times (29.5%) in this 17-year time frame. In the total of all grassland burned at least once in the Flint Hills, only 1.6% was burned in all years of the study while 10% was burned in only one year during the study period. The Flint Hills burn intervals map and burn frequency, using data from 2000-2016, are shown in Figures 3e and 3f, respectively.

Counties	DOY126 (5/5)
Butler	245,921
Chase	318,679
Chautauqua	94,473
Coffey	76,450
Cowley	158,984
Elk	171,757
Geary	51,492
Greenwood	284,624
Lyon	174,213
Marion	75,647
Morris	149,780
Osage (KS)	64,974
Pottawatomie	89,114
Riley	64,110
Wabaunsee	199,804
Wilson	23,136
Woodson	79,276
Nowata (OK)	48,186
Osage (OK)	301,258
Washington (OK)	32,387
Kay (OK)	32,526
Total	2,736,791

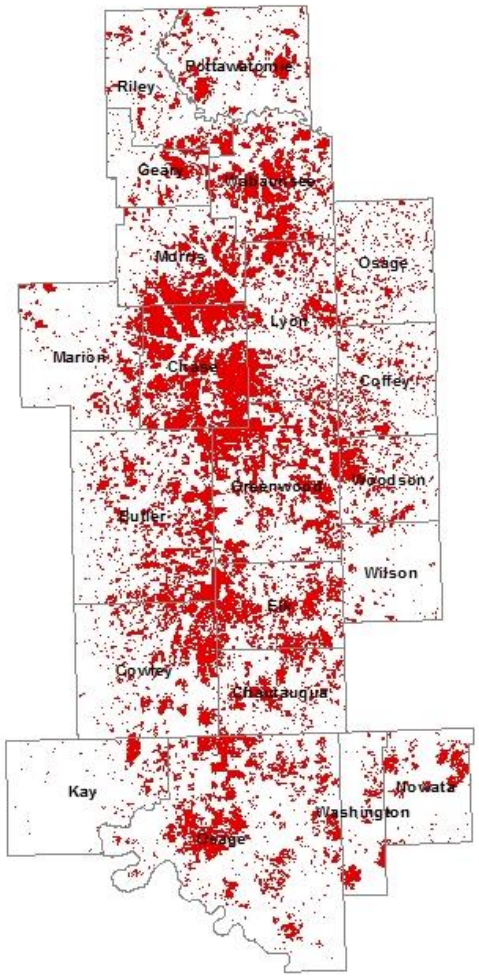

Figure 3d: Satellite Derived Acres Burned in Flint Hills, February 27-April 23, 2016
Source: KDHE, 2016 Kansas Flint Hills Update – June 30, 2016

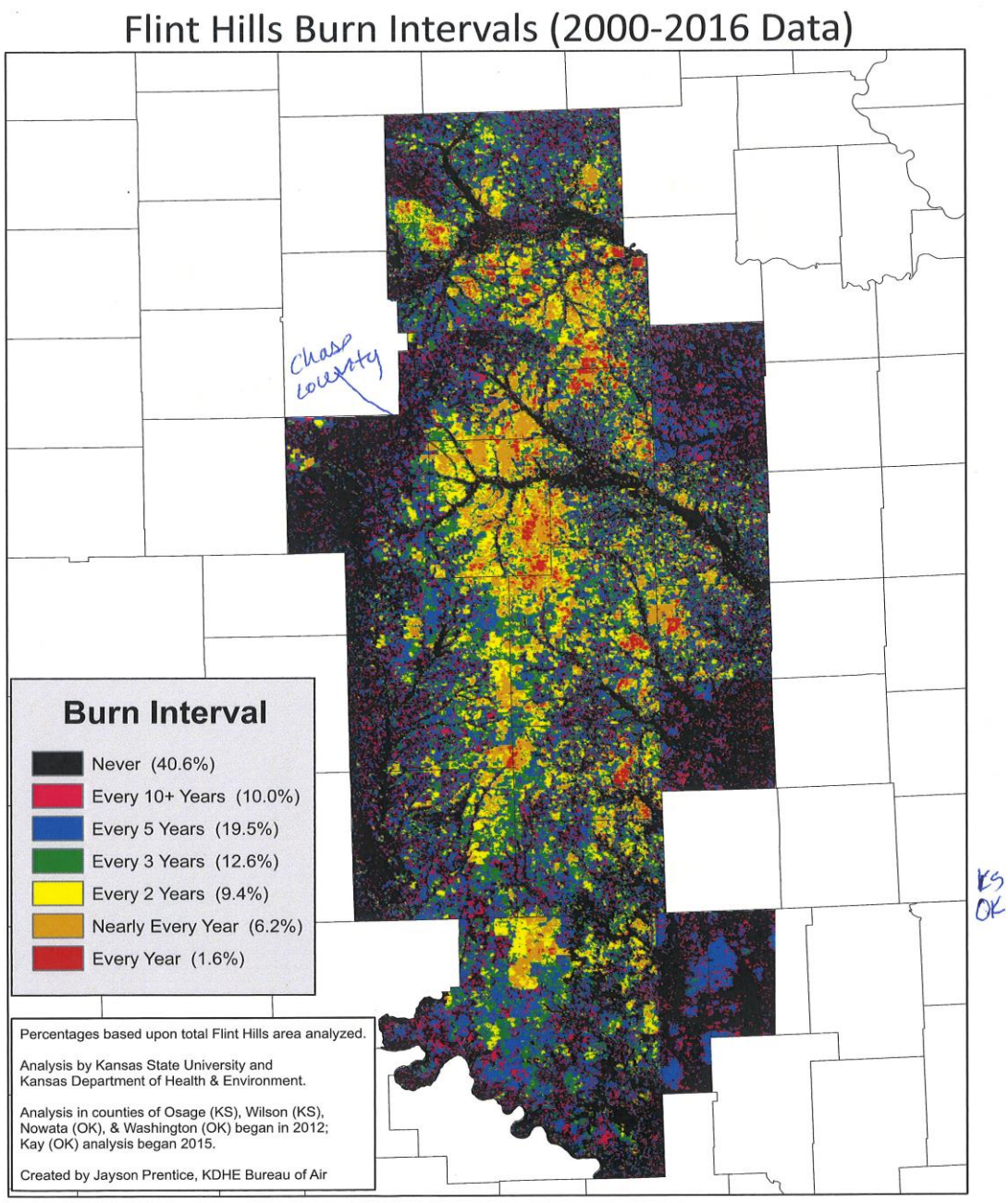

Figure 3e: Flint Hills Burn Interval Map
Source: KDHE

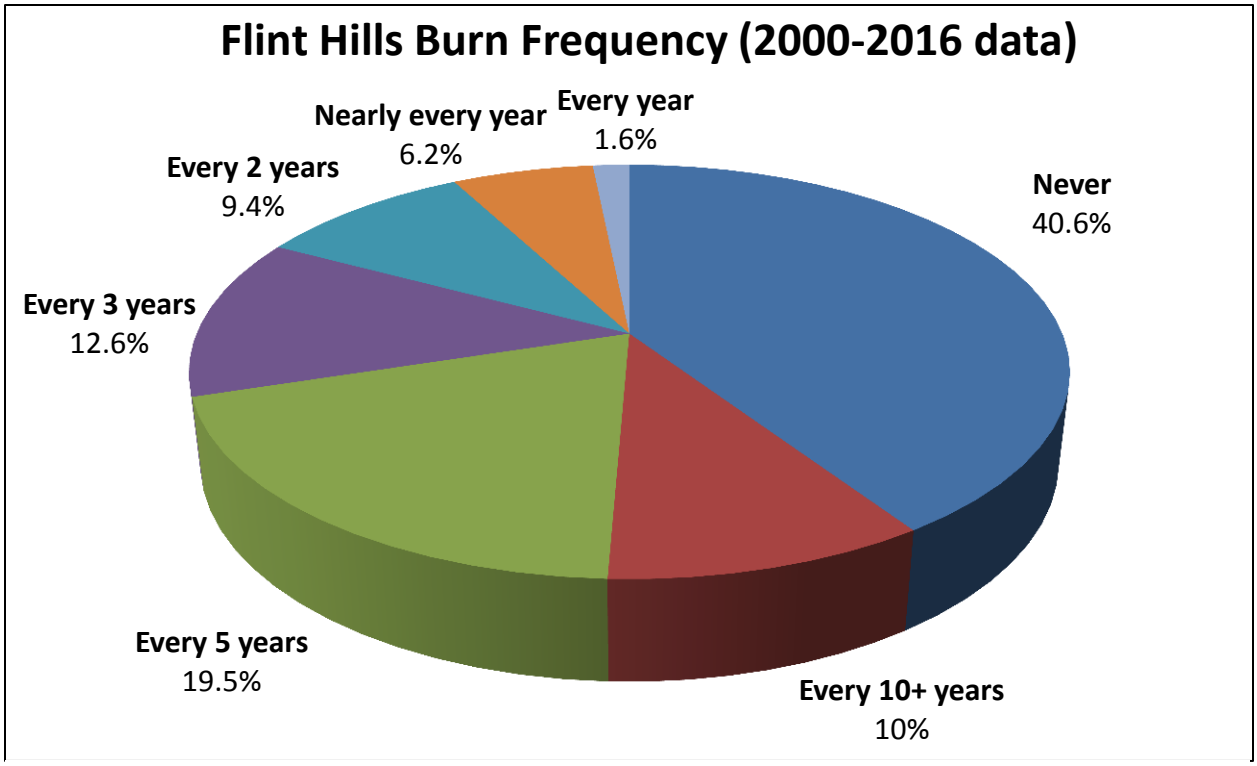

Figure 3f: Flint Hills Burn Frequency, 2000-2016
Source: KDHE

Using the percentages provided in the burn interval map from KDHE, the amount of acres burned by frequency was calculated (Table3-2).

Table 3-2: Flint Hills Acres Burned by Frequency

Burn Frequency (years)	Acres Burned	Percent Burned
1	116,736	1.6%
1-2	452,352	6.2%
2	685,824	9.4%
3	919,296	12.6%
5	1,422,720	19.5%
10+	729,600	10%
Never	2,962,176	40.6%

A paradigm to enhance heterogeneity in order to promote biological diversity and wildlife habitat on rangelands was proposed by Fuhlendorf and Engle (2001). One management practice used to enhance heterogeneity is patch-burn grazing (PBG). This fire-induced grazing regime is

designed to approximate the natural interaction between fire and grazers. Typically, one-third of a PBG pasture is burned each year on a rotational basis. When only a portion of a pasture is burned, livestock focus most of their grazing in the burned patches. This results in accumulation of vegetation in unburned areas, creating wildlife habitat and fuels for fires in subsequent years. The interaction of these disturbances produces a shifting mosaic of vegetative structure. PBG has been suggested as a way to reduce smoke emissions in the Flint Hills. One study (Rensink, 2009) indicates that less biomass would be consumed annually by fire when a pasture was managed with patch burning compared to the entire pasture being burnt annually. However, its effectiveness for smoke reductions remains an open question. Even though only one-third of a pasture is burned each year under PBG management, two years of growth with minimal grazing is also being consumed in the burned patch. It is also important to recognize that some pastures in the Flint Hills may not be well suited to PBG because of the difficulty of maintaining fire breaks, and that the practice may require additional resources (fire equipment and manpower) to implement. PBG is also viewed by some as experimental, and may require additional research before it becomes a widely accepted practice. A fact sheet on this practice is available on the Kansas Flint Hills Smoke Management webpage.[4]

Debate will continue regarding when and how often to burn tallgrass prairie; however, there is wide scientific consensus supporting the need for prescribed fire in native grasslands. One of the greatest threats to the tallgrass region is forestation due to fire suppression. Eastern red cedar, a species readily controlled with fire when trees are small, is rapidly increasing in coverage in Kansas, especially in the eastern half of Kansas. Red cedar and other invasive plant species targeted with herbicides can be managed more economically and with fewer ecologically impacts using prescribed fire.[4]

Until only recently, certain areas of the Flint Hills, especially along the eastern and western flanks of the Flint Hills (e.g., southeastern Greenwood County), lacked a fire culture and seldom burned. As a result, many of these areas experienced heavy encroachment by woody vegetation, and are no longer able to support interior grassland species like greater prairie chickens.[4]

At Konza Prairie, annual burning was the only fire treatment that reduced woody plant density, with rapid increases in woody encroachment for longer (≥4-year) fire-return intervals. Therefore, pastures with a high density of woody vegetation may need higher fire frequency than is currently practiced to reverse years of fire suppression. Annual burning may be less warranted in areas of the Flint Hills where woody vegetation is not a significant problem. Conversely, areas not receiving enough fire to keep ahead of woody encroachment may require burning consecutive years to reverse this trend. In the Flint Hills of Kansas, prescribed fire is used by management actions to meet specific resource objectives that are designed to preserve and restore the essential ecological processes of fire. Fire frequency may vary depending on the natural resource objective to be met, depending on the degree of preservation, restoration, invasive species (pest) control, or reducing the risk of damaging wildfires. The Kansas Flint Hills is a unique ecosystem that is highly dependent on a frequent fire return interval to maintain and sustain the native species composition of the tall grass prairie.[4]

The fire-return interval of the Flint Hills landscape must remain frequent to mimic fire under natural conditions and support the continuation of the wildland prairie ecosystem. Research shows that historically, the natural fluctuation of fire (i.e. the natural fire return interval) of a tall grass ecosystem averaged every two to five years. On average, prescribed fire is applied to approximately one-third of the tall grass prairie every year. While some lands within this vast

ecosystem may burn almost every year, others may burn every five years or less, depending on a number of uncontrollable variables such as precipitation, temperature and flora growth.[4]

However, one can use these average numbers to make two general interpretations: (1) prescribed fire is used roughly once every three years in the Flint Hills and (2) this fire frequency mimics the natural fire-return interval for this ecosystem dating back hundreds of years. Through research and practice it has been proven that lower frequencies of burning will lead to a loss of the ecosystem in only a matter of a few burn cycles.[4]

4. Causal Relationship

A. Summary of Results

This section demonstrates a causal relationship between the smoke due to local and regional fires and the 8-hour ozone concentrations above 0.070 ppm that occurred in Nebraska on April 11, 2015. In particular, this section provides evidence that: (1) smoke from biomass burning can enhance the formation of ozone; (2) smoke from Flint Hills was transported to the impacted monitors on the date when 8-hour ozone concentrations were above 0.070 ppm; and (3) the smoke enhanced ozone formation at specific monitors, resulting in 8-hour ozone concentrations above 0.070 ppm. This evidence includes discussion of fire locations, meteorological conditions, smoke transport, and air quality data on April 11, 2015 when the exceedances occurred.

Meteorological and air quality data indicate that the 8-hour ozone concentration(s) exceeding the NAAQS in Nebraska were caused by smoke from fires in the Flint Hills on April 10 and 11, 2015 (based on fire locations with respect to impacted monitors, wind patterns favorable for transport of smoke to the impacted monitors, and reduced visibilities with smoke and/or haze reported in the vicinity of the impacted monitors).

B. Literature Review Providing Evidence that Biomass Burning Can Result in Elevated Ozone Levels[4]

To establish a relationship between smoke from biomass burning and ozone enhancement, relevant scientific articles from peer-reviewed journals have been referenced in this document. The articles depicted a complex relationship between biomass burning and ozone formation and indicated several cases in which ozone concentrations exceeding the NAAQS were attributable to smoke from biomass burning.

Smoke from biomass burning contains a number of constituents, including ozone precursors such as nitrogen oxides (NO_x) and non-methane hydrocarbons (NMHCs) (McKeen et al., 2002; Jaffe et al., 2008). Previous observational studies have shown that smoke from biomass burning can enhance the formation of ozone under a variety of conditions (e.g., Hobbs et al., 2003; Junquera et al., 2005; Pfister et al., 2006). Ozone enhancement due to biomass burning is highly variable and depends on a number of factors, including fuel type, combustion efficiency, and available solar radiation (Jaffe and Wigder, 2012). In addition, ozone enhancement associated with biomass burning can take place both immediately downwind of a fire and after long-range smoke transport. Junquera et al. (2005) found ozone enhancements of up to 60 ppb within 10 km of fires in eastern Texas. Using ozonesondes, Morris et al. (2006) found a 25–100 ppb increase in aloft ozone concentrations over Texas due to long-range transport of smoke

from wildfires in Canada and Alaska. In the analysis of a November 2009 smoke plume in California, Akagi et al. (2012) found that “despite occurring approximately one month before the winter solstice, the plume was photo chemically active and significant amounts of ozone formed within a few hours”, demonstrating that ozone enhancement due to smoke can take place in the cool season when ozone concentrations are typically lower. Conversely, in some cases, ozone concentrations were shown to be suppressed near wildfires, possibly because of thick smoke obstructing incoming UV radiation and/or titration of ozone due to high NO_x concentrations in the smoke plume (Bytnerowicz et al., 2010; Stith et al., 1981).

Previous studies have also shown that fires have contributed to exceedances of the NAAQS for 8-hour ozone (Jaffe et al., 2004; Junquera et al., 2005; Bein et al., 2008). In addition, using photo-chemical model simulations, Pfister (2008) found 10–15 ppb increases in ozone near fires in Northern California over the September 1-20, 2007, period and near fires in Southern California over the October 15-30, 2007, period, concluding that “intense wildfire periods frequently can cause ozone levels to exceed current health standards.”

In 2011 EPA agreed to a request from the California Air Resources Board (CARB) and the Sacramento Metropolitan Air Quality Management District (SMAQMD) to exclude exceedances of the NAAQS for 1-hour ozone concentrations due to emissions from biomass burning under the Exceptional Events Rule. In that case, CARB and SMAQMD used a weight-of-evidence approach similar to the approach used for this Exceptional Events demonstration—including analysis of air quality and meteorological data, satellite imagery, air parcel trajectories, and photochemical modeling—to show that smoke from wildfires in the summer of 2008 resulted in ozone exceedances in the Sacramento region (Sacramento Metropolitan Air Quality Management District, 2011).

C. Analysis Methods

Several analysis methods were used to assess whether the 8-hour ozone concentrations above 0.070 ppm were caused by smoke. Fire and smoke locations were analyzed in relation to the impacted monitors, and meteorological data were evaluated to determine whether conditions were favorable for transport of smoke from fires to the impacted monitors. Air quality data and visibility observations were used to assess whether smoke was present at the impacted monitors.

1. Existence of Fires and Other Unusual Emissions

For the days surrounding and including the event date, NOAA-HMS fire and smoke plume data were analyzed to determine the locations and spatial extent of the fires/smoke on the event days and to assess whether fires occurred upwind of the impacted air quality monitors. NOAA-HMS maps show the locations of fires and smoke plumes in the Flint Hills region and Nebraska.

To supplement the fire and smoke data described above, news stories regarding fires and smoke on or about April 11, 2015 were acquired from credible media sources. These documents can be found in **Appendix B**.

In addition, NDEQ has reviewed media documents and contacted local agencies regarding the April date that is the subject of the exceptional event request and are unable to find any emergency conditions, other large local fires, or other anthropogenic events that occurred on the four days that would potentially cause the high ozone readings on the days in question.

2. Meteorological Conditions and Smoke Transport

Smoke transport, which refers to the movement of the smoke plumes, is important because the smoke plumes likely contained ozone and ozone precursors. Smoke transport was analyzed by reviewing navigator maps from AirNow showing fire, smoke, and wind barbs for April 9-12, 2015.

Wind and temperature data from the National Weather Service (NWS), in addition to Navigator maps from AirNow-Tech, were analyzed to show the correlation between meteorological conditions and smoke transport to the impacted monitors. These data were evaluated with the fire and smoke maps from NOAA to obtain a comprehensive view of the meteorological patterns on the days when 8-hour ozone concentrations were above 0.070 ppm.

AirNow -Tech was used to create Navigator maps showing fire, smoke plumes, and ozone levels for monitors impacted by the Flint Hills burning. AirNow-Tech allows for easy visualization of several data sets, including air quality observations, meteorological data, fire and smoke data, and wind barbs.

3. Air Quality Conditions

Time-series of air quality and meteorological parameters were analyzed to assess the presence of smoke at the impacted monitors. Marked increases of ozone concentrations, in coincidence with similar increases in PM_{10} and $PM_{2.5}$ concentrations and decreases in observed visibility, may indicate the arrival of smoke in the vicinity of the impacted monitors. In addition, specific meteorological conditions (such as smoke, haze, or thunderstorms) reported at airports by human observers were considered.

D. Findings

This subsection contains the results of the causal relationship demonstration for April 11, 2015 when the 8-hour ozone exceedance occurred. These findings include fire and smoke locations, meteorological conditions and smoke transport, and air quality conditions that relate to the exceedances on this date.

To summarize:

- Smoke from prescribed fires in the Flint Hills area on April 10-11, 2015 were a significant contributing pollutant source for the elevated ozone and $PM_{2.5}$ levels that existed on April 11, 2015 in eastern Nebraska and the Lincoln and Omaha MSAs.

- Winds from the west-northwest on April 10 initially moved pollutants to the east, but the winds switch to the south later that day, moving accumulated and newly emitted smoke pollutants from the Flint Hills into eastern Nebraska. Winds continued from the south throughout April 11-12, 2015.

- The timing of $PM_{2.5}$ concentration peaks was consistent with a contributing source from the south. $PM_{2.5}$ concentrations increased earlier at Lincoln than at Omaha on the morning of April 11, 2015. The elevated $PM_{2.5}$ levels were followed by increases in ozone as the day progressed.

- As both $PM_{2.5}$ and ozone are formed *in situ* as a result of atmospheric reactions, it is reasonable, given the wind directions that existed, that the brunt of the impact on eastern Nebraska occurred on April 11, 2015.

1. Existence of Fires and Other Unusual Emissions

KDHE notified NDEQ that there would be extensive burning in the Flint Hills region on April 10-11, 2015. Based on the weekly estimate of acres burned for the week of April 4-10, approximately 45,000 acres were burned daily[6]. Fires were concentrated in the Flint Hills region, generally south of Topeka and east of Wichita, with additional fires extending further south into Oklahoma (Figure 4a).

On April 10, 2015, fires were present in the Flint Hills, however, smoke plumes were primarily present to the east and southeast of the region.

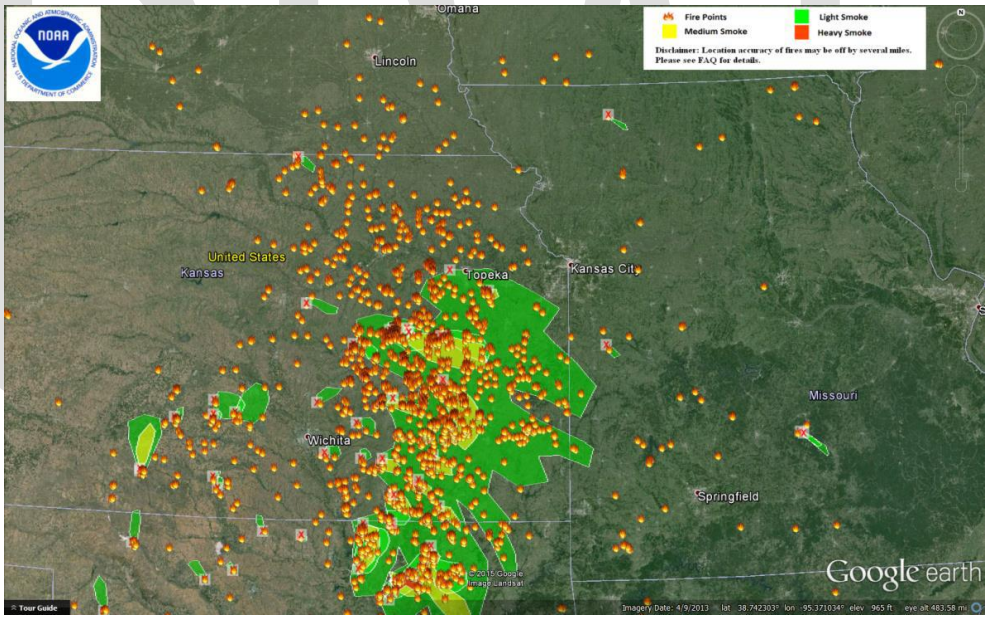

Figure 4a: Flint Hills Fire and Smoke, April 10, 2015
Source: KDHE, NOAA

[6] Weekly acreage estimates were given in the KDHE MARC Air Quality Forum Meeting presentation (Kansas City, MO, April 14, 2015) and the Flint Hills Prescribed Fire Update presentation (for the week of April 10-17, 2015).

[7] Excluding days on which concentrations caused by exceptional events exceed the 95th percentile threshold employs

On April 11, Fires continued to burn and, due to shifting winds, smoke was transported into eastern Nebraska and states to the east and north (Figures 4b and 4c).

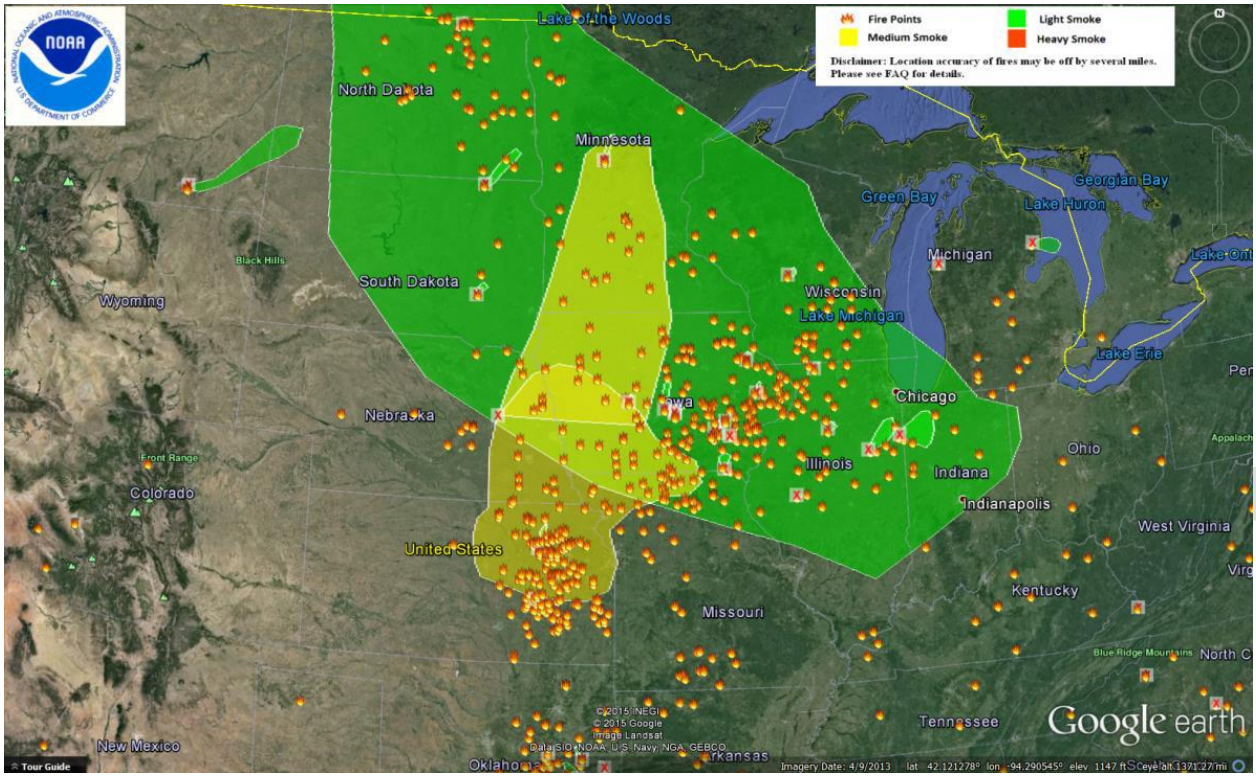

Figure 4b: Flint Hills Fire and Smoke, April 11, 2015
Source: KDHE, NOAA

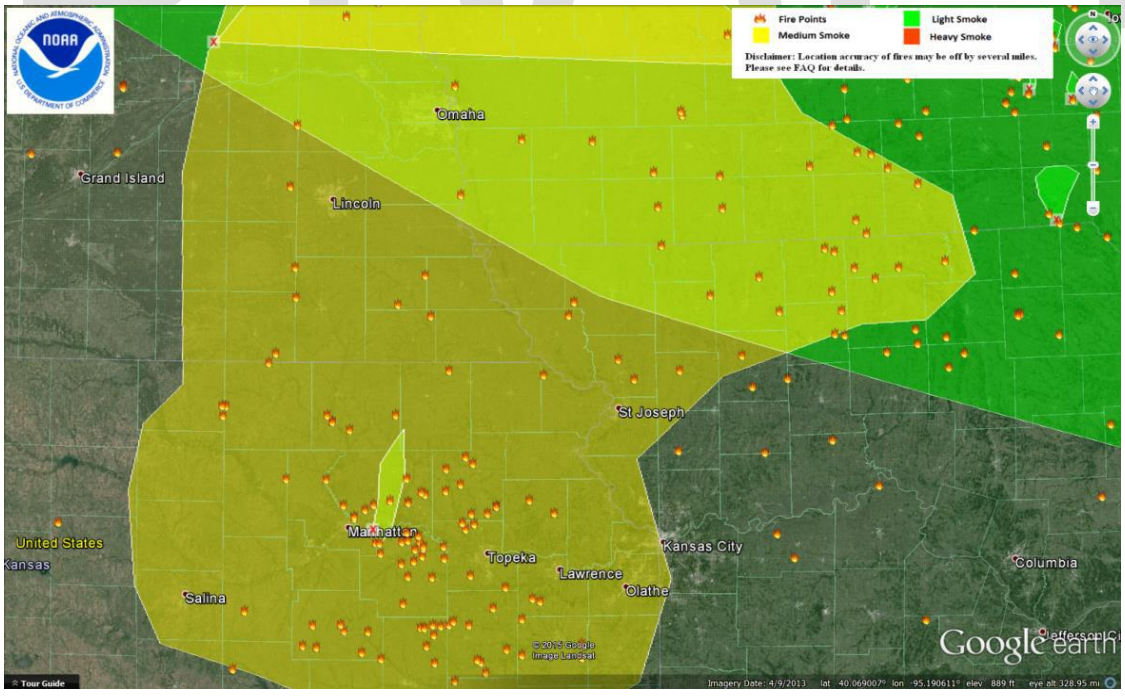

Figure 4c: Flint Hills Fire and Smoke (NE Kansas/SE Nebraska), April 11, 2015
Source: KDHE, NOAA

2. Meteorological Conditions and Smoke Transport

Meteorological conditions on April 11, 2015, indicated transport of smoke from fires in the Flint Hills to the impacted monitors. Numerous changes began to take place in Lincoln: barometric pressure began to fall, wind speed began to increase with a change in direction, while ambient temperature and dew point began to rise mid-day (Figure 4d).

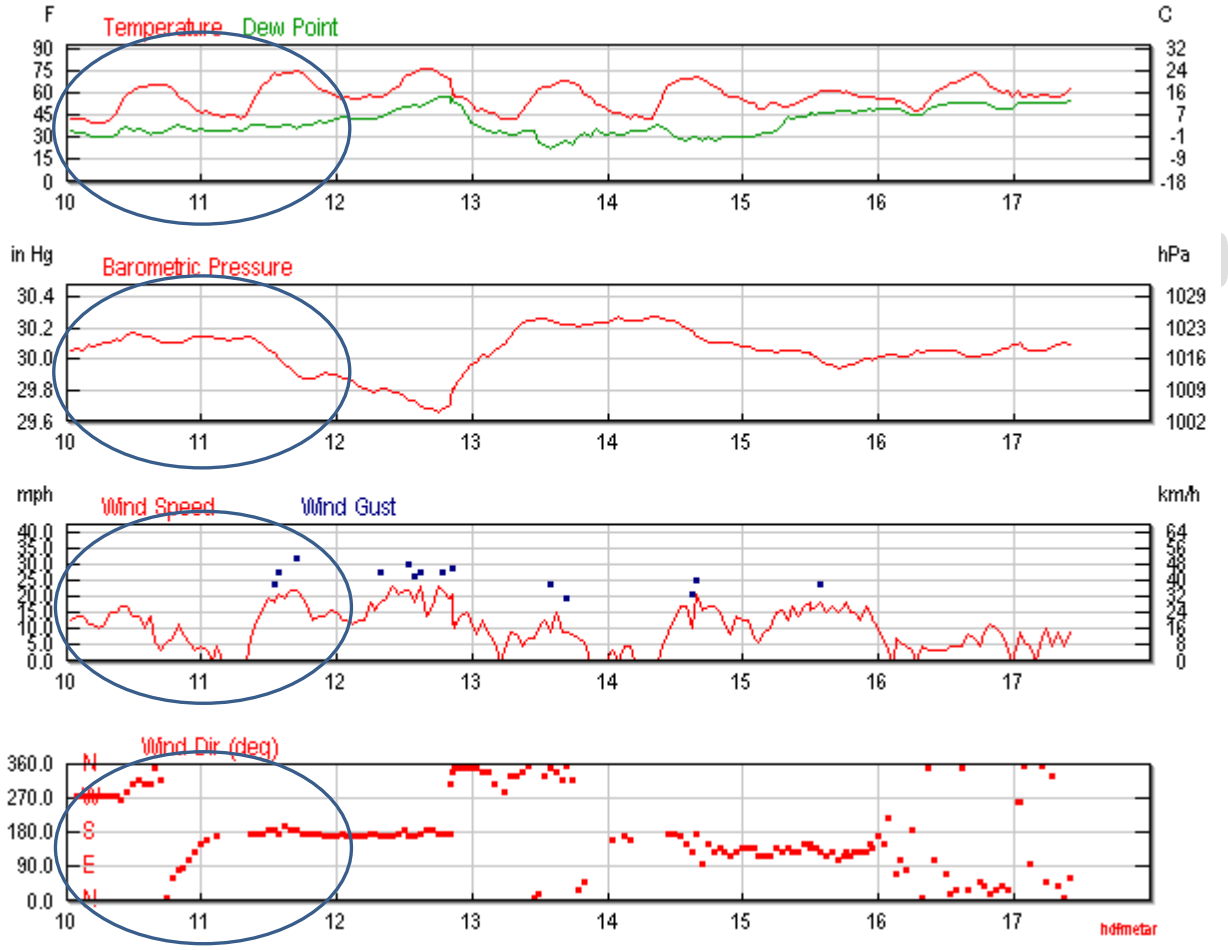

Figure 4d: Meteorological Changes (Lincoln, NE), April 11, 2015
Source: KDHE

The Navigator map (Figure 4e) shows numerous prescribed fires in the Flint Hills area on April 10, with localized plumes extending to the east-southeast. There are also fires were set north of the Flint Hills area including eastern Nebraska, but the preponderance of burning appears be in the Flint Hills area. Wind initially is from the northwest, but begins to shift and comes from the south later in the day (i.e., from 16:00 to 20:00 CST).

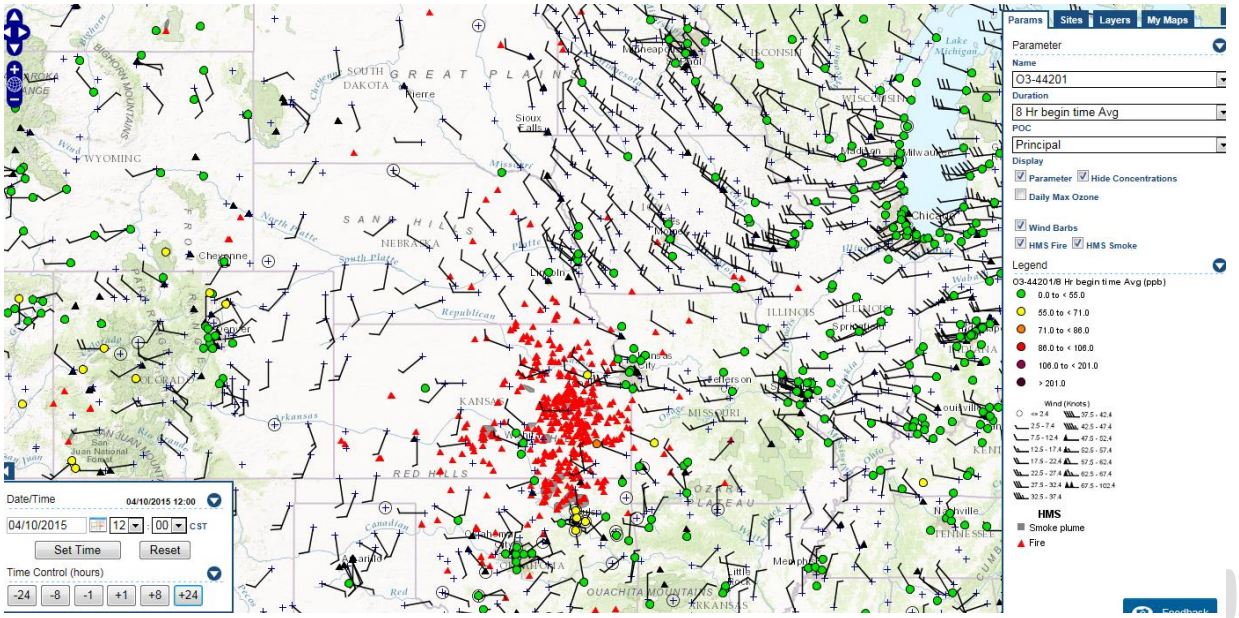

Figure 4e: Map with 8-hour Ozone AQI Forecast and Wind Barbs (April 10, 2015, 12:00 CST)
Source: AirNow-Tech

By the end of the day, there were southeasterly winds in northeast Missouri and southwest Iowa, and south-southeasterly winds from Kansas (Figure 4f). This may have created a situation where wind vectors brought smoke pollutants that had originally migrated into northwestern Missouri back into eastern Nebraska, while the south-southeasterly winds in Kansas are also bringing smoke from the Flint Hills into eastern Nebraska.

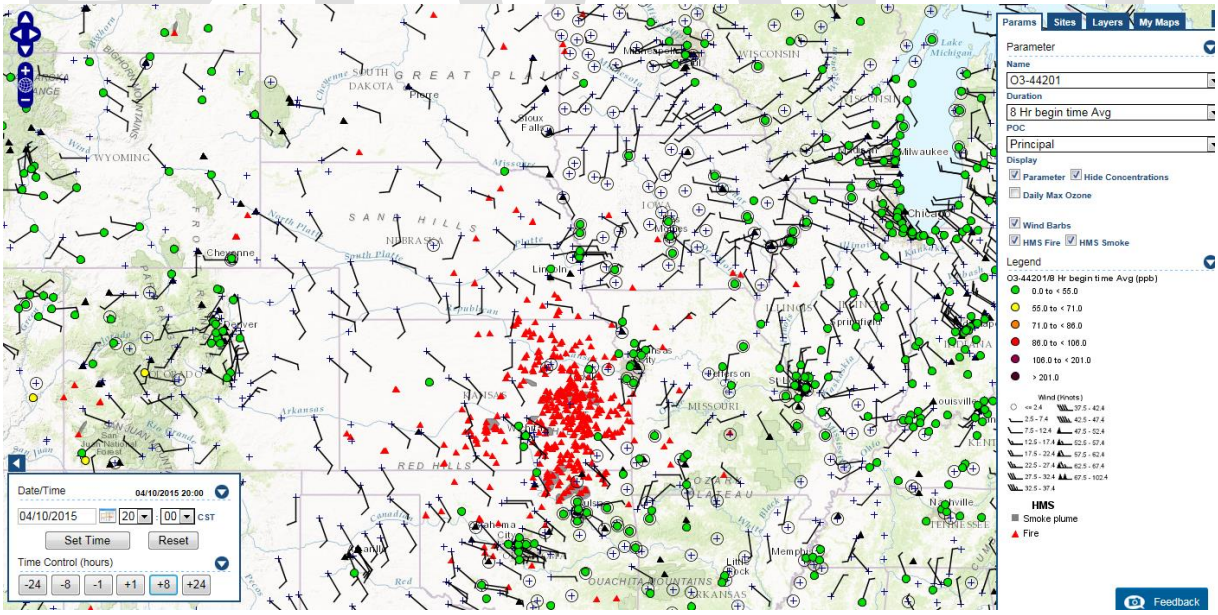

Figure 4f: Map with 8-hour Ozone AQI Forecast and Wind Barbs (April 10, 2015, 20:00 CST)
Source: AirNow-Tech

The navigator map (Figure 4g) shows numerous prescribed fires in the Flint Hills area on this date, but less than on April 10, 2015. There is also burning in eastern Nebraska and increased burning (more than the previous day) in northern Missouri and Iowa. The most concentrated burning is in the Flint Hills area.

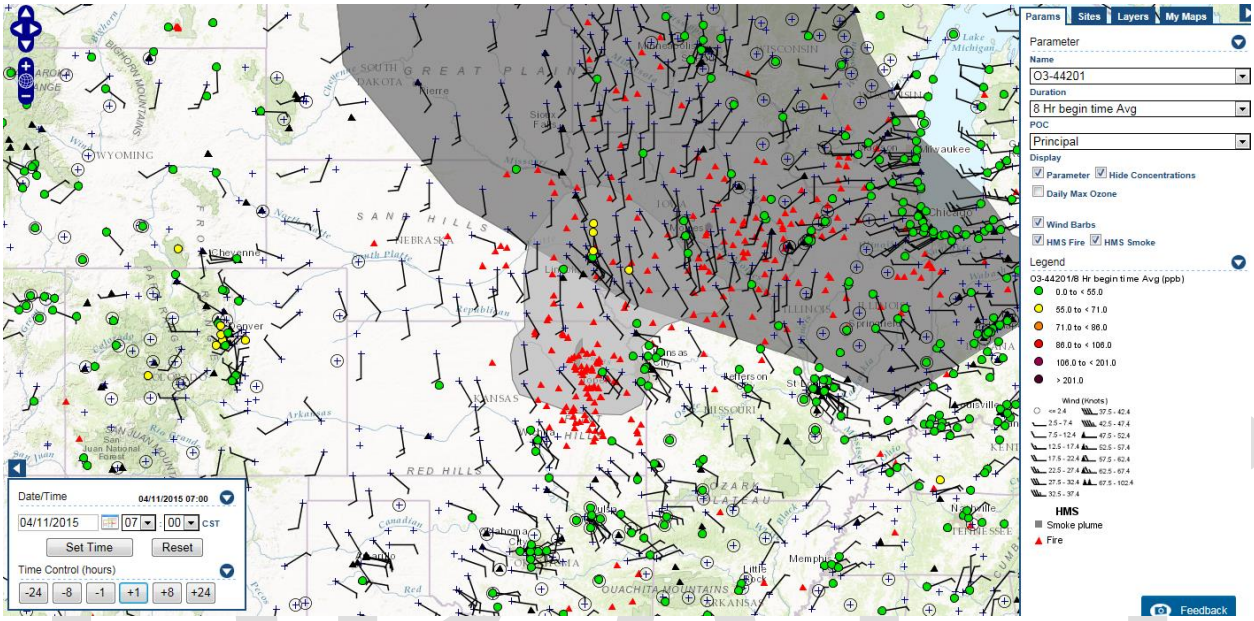

Figure 4g: Map with 8-hour Ozone AQI Forecasts and Wind Barbs (April 11, 2015, 07:00 CST)
Source: AirNow-Tech

The Navigator map also shows a large smoke plume extending from northwestern Ohio and southern Illinois northwesterly into Canada covering all or parts of 11 states, including northeast Nebraska. This large plume does not appear to have much impact on ground-level ozone, as shown by the green AQI forecasts for most sites under it.

The map also shows a smaller smoke plume extending from the Flint Hills into eastern Nebraska, northwest Missouri and western Iowa. The AQI forecasts for sites under this plume do appear to indicate elevated ozone and $PM_{2.5}$.

In the early hours of April 11, the southeasterly winds from Missouri and the south-southeasterly winds from Kansas continue. At approximately 07:00 CST, the winds begin to alter direction and come primarily from the south. This is the point at which $PM_{2.5}$ levels begin to increase in Lincoln, NE. Ozone levels are already increased in the Omaha area and PM2.5 levels begin to increase at approximately 09:00 CST.

3. Air Quality Conditions

Air quality conditions show deterioration on April 11-12, 2015. Daily maximum values for $PM_{2.5}$ and ozone are shown in Table 4-1.

Hourly $PM_{2.5}$ and ozone pollutant levels in the Lincoln MSA and the Omaha NCore site from April 9-12, 2015 are shown in Figures 4h and 4i. Note that at both locations, $PM_{2.5}$ readings spiked in the early daylight hours of April 11 and then ozone increased reaching peak

concentrations in the afternoon. Ozone concentrations at Nebraska monitors on April 11, 2015 are shown in Figure 4j.

Table 4-1: $PM_{2.5}$ and Ozone Daily Maximum Data for the Lincoln MSA and Omaha NCore sites, April 9-12, 2015

	Lincoln MSA				Omaha NCore Site			
	$PM_{2.5}$ (ug/m^3)		Ozone (ppb)		$PM_{2.5}$ (ug/m^3)		Ozone (ppb)	
	Hourly Maximum	24-Hr Average	Hourly Maximum	Max 8-Hr Average	Hourly Maximum	24-Hr Average	Hourly Maximum	Max 8-Hr Average
4/9/15	21	8.1	35	27	14	6.3	39	28
4/10/15	13	7.2	45	42	12	6.1	50	45
4/11/15	76	32.0	73	63	61	25.0	87	76
4/12/15	70	16.6	54	46	31	11.4	58	51

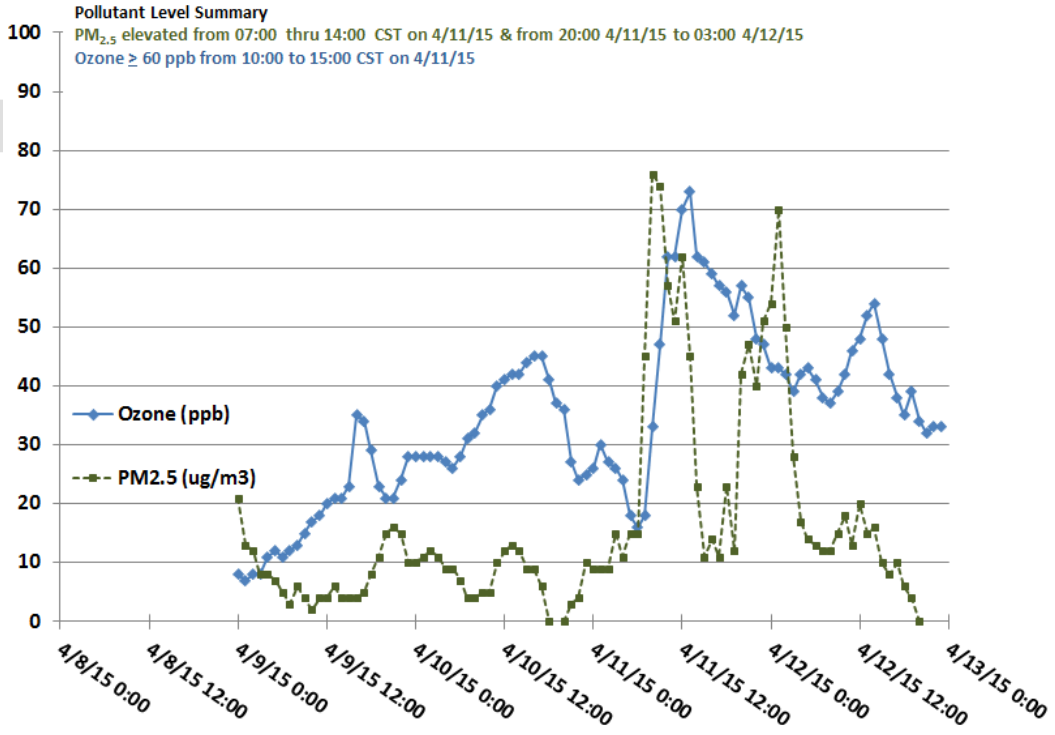

Figure 4h: Hourly $PM_{2.5}$ and Ozone Levels: Lincoln MSA, April 9-12, 2015
Source: AirNow-Tech

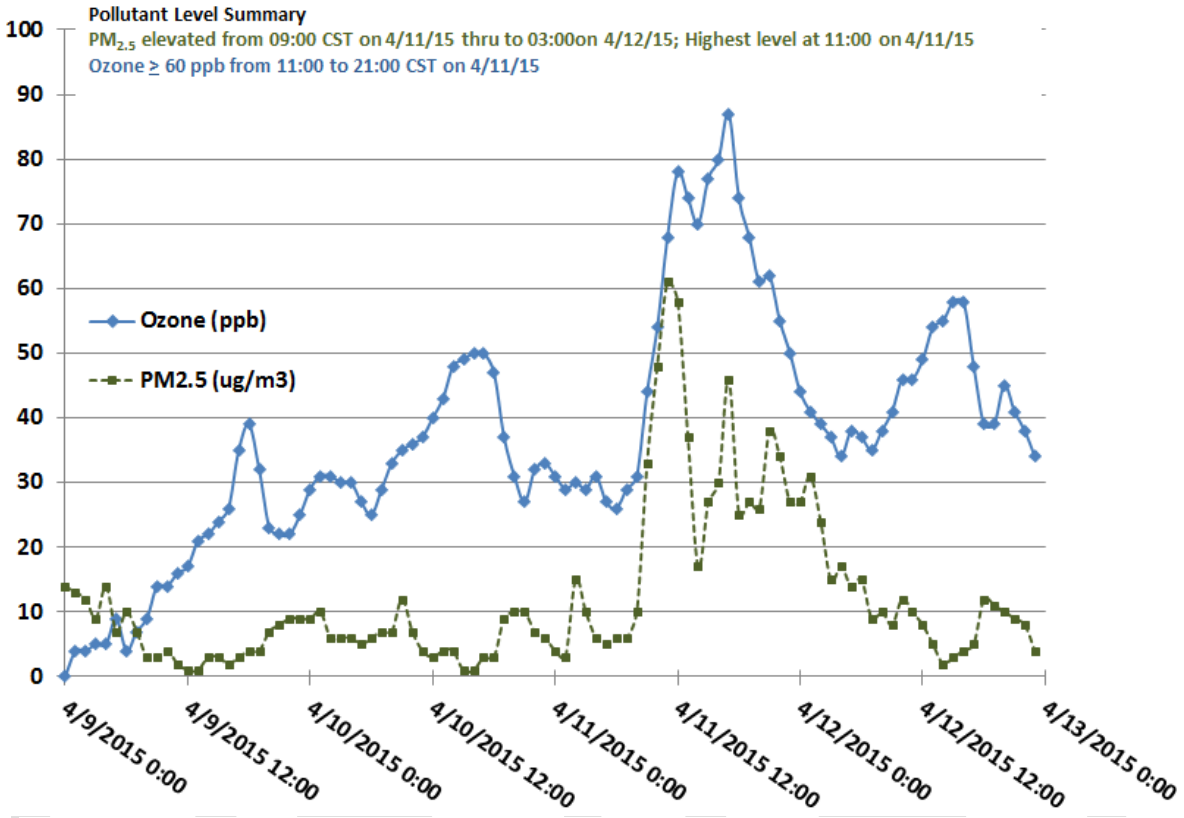

Figure 4i: Hourly $PM_{2.5}$ and Ozone Levels: Omaha NCore site, April 9-12, 2015
Source: AirNow-Tech

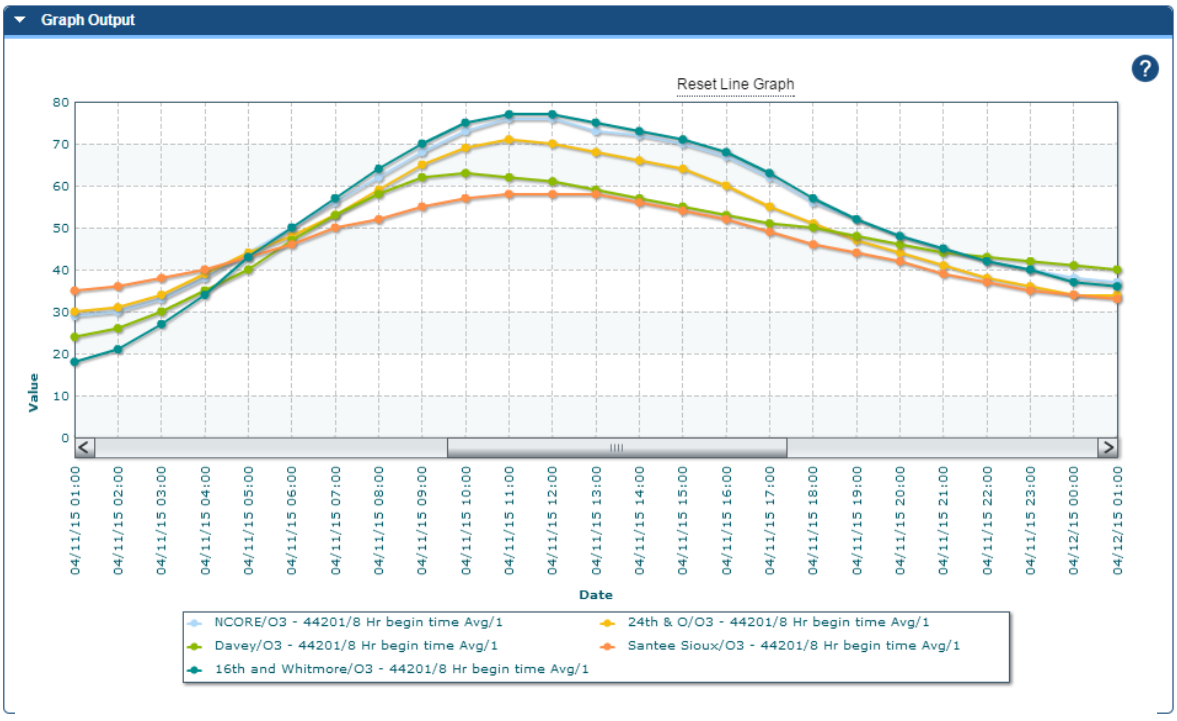

Figure 4j: Ozone Concentrations at Nebraska Monitors on April 11, 2015
Source: Kansas Flint Hills 2015 Update, Aug 18, 2015, KDHE

Summary

These findings demonstrate that ozone and ozone precursors in smoke plumes from fires in the Flint Hills caused the 8-hour ozone NAAQS exceedances at the NCore, South Omaha, and Whitmore monitors on April 11, 2015. Factors supporting this conclusion include:

- Widespread burning in the Flint Hills region on April 10-11, 2015
- Low-level winds and wind barbs showing transport of smoke from fires to the impacted monitors
- Reductions in visibility, increases in PM concentrations, and visual reports of smoke in coincidence with rapid increases in ozone concentrations at the impacted monitors
- 8-hour ozone concentrations below 0.070 ppm at monitors that were not impacted by smoke
- No other unusual emission sources that would have caused the high ozone concentrations

5. Historical Norm

A. Summary of Results

Evidence shows that ozone concentrations on April 11, 2015 were unusual and in excess of normal historical fluctuations. Key points include:

1. On the event date, ozone concentrations were highest in the areas with greatest smoke impacts. The concentrations reported for this date were the only exceedances reported during April 2011-2016 and values were in the 99th percentile.

2. The wind direction on April 11, 2015 was from the south, which contributed to smoke transport into Nebraska and increased ozone concentrations.

3. Because high ozone levels are typically associated with warmer temperatures, it would be expected, in the absence of an exceptional event, that the ozone concentrations on days with higher temperatures would also be greater.

B. Methods

Two techniques were used to develop a weight of evidence demonstrating whether the measured ozone values on April 11, 2015 were in excess of normal historical fluctuations, including:

1. **Comparing observed ozone concentrations on April 11, 2015 to historical observations.**
   The purpose of this analysis is to determine whether the observed ozone concentrations on the event date were in excess of normal historical fluctuations; this is the primary method for assessing whether the 8-hour ozone concentrations on the smoke-impact date were unusual. For this assessment, historical daily cumulative distributions of daily 8-hour ozone concentrations were compiled, by monitoring site, for the April 2011-2016 period. Concentrations in excess of the 95$_{th}$ percentile are considered to be unusual.[7]

2. **Comparing observed ozone concentrations on April 11, 2015 to days with higher temperatures.**
   The purpose of this analysis is to determine whether the observed ozone concentrations on the event date were in excess of concentrations observed on dates with higher temperatures and no smoke impacts. Because high ozone concentrations normally occur on warm, cloud-free days, it would be expected that days with higher temperatures would reflect higher ozone concentrations, without smoke impacts.

[7] Excluding days on which concentrations caused by exceptional events exceed the 95$_{th}$ percentile threshold employs a general test of statistical significance and has the effect of ensuring that such concentrations would clearly fall beyond the range of normal expectations for air quality during a particular time of year. Source: “The Treatment of Data Influenced by Exceptional Events,” 71 FR 12598

C. Findings

1. Historical Cumulative Distributions

The 8-hour ozone concentrations on April 11, 2015 were above normal historical levels. Table 5-1 shows the historical norms for April for the period 2011-2016. Wind direction is atypical for the event date and, as shown in section 4, facilitated smoke transport to the affected Nebraska monitors.

Table 5-1: Temperature and Wind Data for Omaha, 2011-2016

Parameters	**Normal values**[a,b]	**April 2011**	**April 2012**	**April 2013**	**April 2014**	**11-Apr-15**	**April 2016**
avg temp (K)	284.1	285.4	287.2	274.3	288.2	**288.3**	278.2
avg temp (F)	51.7	54	57	34	59	**59**	41
high temp (F)	63.7	67	60	37	77	**75**	54
wind speed (mph)	13	11.5	5.4	12.7	8.4	**6.7**	6.2
wind direction (°)	not avail	330	330	290	162	**165**	180
wind direction	N	NNW	NNW	WNW	SSE	**SSE**	S
Monitors	**Design Value**[c]						
NCore (ppm)	0.066	0.058	0.057	0.056	0.068	**0.076**	0.062
South Omaha (ppm)	0.061	0.054	0.054	0.050	0.064	**0.071**	0.061
Whitmore (ppm)	0.066	0.051	0.057	0.051	0.066	**0.077**	0.061

[a] *1981-2010 Climate Normals* for Omaha, NE (Eppley Airfield Station), NOAA National Climatic Data Center, http://www.ncdc.noaa.gov/cdo-web/datatools/normals

[b] Daily normals for Omaha, NE (Eppley Airfield station) from Climatic Wind Data for the United States, 1930-1996 (Nov 1998), http://www.ncdc.noaa.gov/sites/default/files/attachments/wind1996.pdf

[c] Three-year Design Values for Ozone Monitors, Table B-1, 2015 Ambient Air Monitoring Network Plan, NDEQ

The 8-hour ozone concentrations on April 11, 2015 at the three affected monitors were the highest of any day at those sites in April in the multi-year data set, and were calculated to be in the 99th percentile for entire period 2011-2016 for April (Table 5-2).

Table 5-2: 99th Percentile Values for 8-Hour Ozone (ppb) in April from 2011 thru 2016

Year	NCore[a]	South Omaha[a]	30th & Fort[b]	Whitmore[c]	30th & Fort/ Whitmore Combined
2011	58	54	51	-	-
2012	57	54	57	-	-
2013	56	50	51	-	-
2014	68	64	66	-	-
2015	76	71	-	77	-
2016	62	61	-	61	-
All Years	**68**	**64**	**62**	**77**	**66**

[a] April data, 2011-2016 (180 days)

[b] The 30th & Fort Site was shut down due to construction in 2014; this monitor was moved to the Whitmore site and operational starting in 2015. April data, 2011-2014 (120 days)

[c] April data: 2015-2016 (60 days)

2. Temperatures and Ozone Concentrations

Overall temperatures on April 11, 2015 were much lower than on other days with higher temperatures and lower ozone concentrations (Table 5-3). Because high ozone levels are normally associated with warmer temperatures, the cooler temperatures on the event date suggest that the ozone exceedance was the result of unusual circumstances, such as a change in emissions (e.g., smoke). It is important to note that the days selected for comparison occurred in July, which is climatologically warmer than April in Nebraska. In addition, the ozone concentrations on the event date were higher than on any of the comparison days (which had higher average and maximum temperatures and no smoke impact) despite both lower overall temperatures and roughly two hours less daylight than the comparison days (ozone formation is normally enhanced with a higher sun angle and longer periods of daylight).

Table 5-3 - Comparison of Event Date Ozone Concentrations to Higher Temperature Days

	EVENT April 11, 2015	July 12, 2015	July 17, 2015	July 24, 2015
Hours of daylight (HH:MM)[a]	**12:49**	**14:56**	**14:50**	**14:38**
avg temp (F)[a]	60	86	85	88
high temp (F)[a]	74	95	97	99
wind spd (mph)[a]	6.7	9.7	11	9
wind dir (degrees)[a]	165	170	170	180
NCore (ppm)[b]	0.076	0.039	0.050	0.056
South Omaha (ppm)[b]	0.071	0.036	0.045	0.045
Whitmore (ppm)[b]	0.077	0.046	0.053	0.061

[a] Quality Controlled Local Climatological Data (QCLCD), NOAA

[b] Air Quality System (AQS), US EPA

Ozone concentrations on the event date, despite lower temperatures, were higher than concentrations on days with higher temperatures and no smoke impacts. This would indicate that smoke transport has contributed to ozone concentrations at these monitors.

6. "But For" Demonstration

A. Introduction

The purpose of this section is to demonstrate that the 8-hour ozone concentrations above 0.070 ppm on April 11, 2015 would not have occurred but for the presence of smoke at the impacted monitors (known as a "But For" demonstration). The analysis used in this demonstration was comparison of ozone concentrations on days when meteorological conditions were similar but no smoke impacts were present.

B. Summary of Results

Table 6-1 summarizes the results of the "But For" demonstration. **This analysis indicates that the April 11, 2015 8-hour ozone concentrations above 0.070 ppm would not have occurred but for the presence of smoke.**

Table 6-1 - Impact of Flint Hills fires on Average Ozone Concentrations on Nebraska Air Monitors on April 11, 2015

Monitor	Peak 8-hour Ozone Concentration (ppm)		
	Observed April 11, 2015	Day without smoke impact (average)	Impact of Flint Hills fires
NCore	0.076	0.057	0.019
South Omaha	0.071	0.049	0.022
Whitmore	0.077	0.056	0.021

C. Matching Days

1. Methods

To assess whether 8-hour ozone concentrations would not have been above 0.070 ppm but for the smoke impacts, ozone concentrations on the smoke-event days were compared to ozone concentrations on days when meteorological conditions were similar but there were no smoke impacts. The historical days were first filtered quantitatively for conditions similar to the smoke-event date, April 11, 2015. The parameters chosen for comparison are standard meteorological observations including daily average temperature, surface wind speeds, and wind direction. Standard deviations were then calculated for the parameters of the resulting potential matches with respect to those of the event date. Dates with the lowest standard deviation from the event were selected, and then filtered for smoke impact; days when smoke may have impacted the monitor were not considered. Smoke impact was assessed using satellite imagery and burn season dates.

When a reasonable match was identified, 8-hour ozone concentrations on the smoke impact day and the matching day were compared at the affected monitors. If the 8-hour ozone concentration was not above 0.070 ppm on the matching day, it is unlikely that 8-hour ozone concentrations would have been above 0.070 ppm on the smoke-impact day in the absence of smoke. The following subsections describe the meteorological conditions and ozone concentrations on the meteorologically matching days for each of the smoke-event date of April 11, 2015. A more detailed description of meteorological conditions on the smoke-event date and dates just prior and following the event date can be found in Section 4 (Causal Relationship) of this document.

2. Matching Day Results

Smoke Event Day: April 11, 2015 **Matching Days:** March 12 and May 2, 2015[8]

Impacted Monitors: NCore, South Omaha, and Whitmore monitors

Summary: The Flint Hills burn season for 2015 began on March 12 and ended on April 30. Comparisons to the days listed above are shown in the table below (Table 6-2)

Table 6-2: Matching Day Results

Ranking in comparison to Event parameters (based on Standard Deviation)	1	EVENT	2
	12-Mar	11-Apr	2-May
average temp (K)	287.1583	288.325	291.1125
average temp (F)	57	60	65
high temp (F)	76	74	72
wind speed (mph)	6.066667	6.695833	7.18875
wind direction (degrees)	164.125	165.0833	165.5
NCore monitor (ppm)	0.061	0.076	0.053
South Omaha monitor (ppm)	not avail*	0.071	0.049
Whitmore monitor (ppm)	not avail*	0.077	0.056
* monitors operate from 1 April - 1 Oct during ozone season			
2015 Burn season dates: March 12 - April 30, 2015			

Burning was extensive during the week leading up to the exceptional event date (April 4-10, 2015) with approximately 313,077 acres burnt (an average of 45,000 acres per day). NDEQ received email notification from KDHE that burning would be significant for April 10-11, and that impacts should be anticipated in Nebraska due to strong south-southwest winds predicted for the weekend (April 11-12).

An analysis of conditions on the matching days illustrates the following:

A. Temperature, wind speed, and direction were very similar for March 12 and May 2; however, 8-hour ozone concentrations on this date were significantly lower than those recorded on April 11, primarily due to the lack of smoke impact.

[8] Standard deviation for parameters compared for April 11, 2015 did not exceed a value of 1.5.

B. Ozone concentrations at each respective monitor on the matching days, when compared to concentrations on the event date, are lower by more than 19%.
C. But for the prescribed burning in the Flint Hills on April 11, 2015, ozone concentrations exceeding the 8-hour NAAQS of 0.070 ppm would not have occurred.

While the 2015 burn season began on March 12, satellite imagery showing the estimated acres burned shows that the acres burned were minimal for this date (Figure 6a).

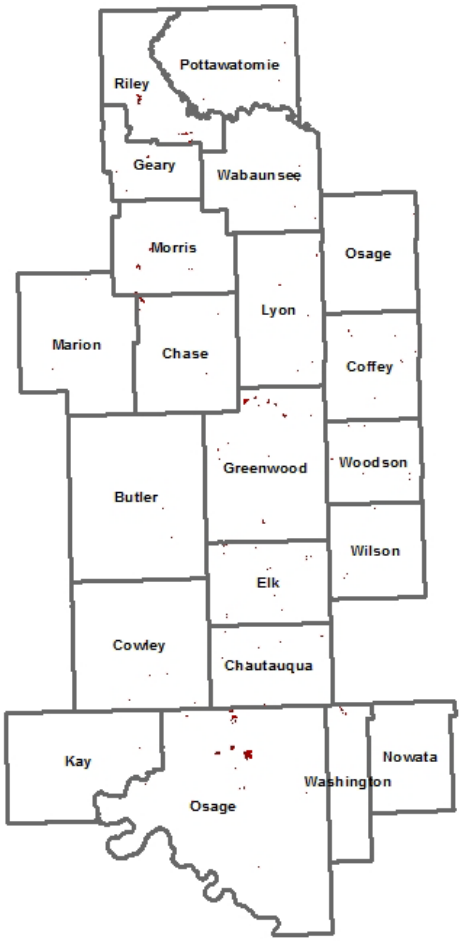

Figure 6a: Satellite Derived Acres Burned in Flint Hills up to March 12, 2015
Source: KDHE, Flint Hills Burn 2015 Burning Season – September 2, 2015

Although the NCore monitor was the only ozone monitor in operation (of the monitors affected on the event date of April 11, 2015), it is reasonable to infer that the concentration recorded on March 12 is indicative of a peak concentration for this date, based on the fact that the Whitmore monitor (located 6.7 miles north-northeast of the NCore monitor) recorded a concentration only 0.001 ppm higher than the NCore monitor on the event date and historical concentrations (shown in Table 5-1) tend to read the highest at the NCore and Whitmore monitors, as compared to the South Omaha monitor.

On March 12, 2015, the maximum 8-hour average ozone concentrations at the NCore monitor were below the federal 8-hour ozone standard (at 0.061 ppm). Thus, it is unlikely that the 8-hour ozone concentrations above 0.070 ppm would have occurred on the event date in the absence of smoke impact at this monitor.

On May 2, 2015, the maximum 8-hour average ozone concentrations recorded at the NCore, South Omaha, and Whitmore monitors were all well below the federal 8-hour ozone standard (0.053, 0.049, and 0.056, respectively). Thus, it is unlikely that the 8-hour ozone concentrations above 0.070 ppm would have occurred on the event date in the absence of smoke impacts at these monitors.

Local Conditions – Omaha Area: Surface temperatures observed in Omaha were very similar on the smoke-event and matching days. Skies were sunny over Omaha on the event date as well as March 12 and May 2. Surface winds on all of these days were very similar in speed and direction. On the matching day of March 12, numerous fires were burning in the Flint Hills region south of Omaha; however, visibility in the area was not impacted by smoke.

7. Conclusions

On April 11, 2015, air quality in Nebraska was affected by smoke from widespread prescribed burning in the Flint Hills region of the southern Plains. Peak daily 8-hour ozone concentrations were above the federal 8-hour standard of 0.070 ppm at one or more Kansas monitors on April 11, 2015. This report provides assessment of the concentrations exceeding the 8-hour ozone NAAQS of 0.070 ppm as Exceptional Events, and analyses demonstrate that the 8-hour ozone concentrations above 0.070 ppm meet the criteria for designation as Exceptional Events.

Specifically, we found that the 8-hour ozone concentrations above 0.070 ppm:

1. Were caused by smoke from fires (Section 4);
2. Were unusual when compared to normal historical values (Section 5); and
3. Would not have occurred but for the smoke from these fires (Section 6).

8. Public Comments

NDEQ, in accordance with the requirements listed in 40 CFR 50.14 (c)(3)(i) Submission of demonstrations, posted this Exceptional Events Demonstration Package on the Agency website for public comment from August 25 through September 27, 2016. In compliance with 40 CFR 50.14 (c)(3)(v), NDEQ is including the public comments received in this section.

(these documents will be included in the final draft)

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APPENDIX A – Agency Press Releases

KDHE News Release

A to Z Topic Listing

Curtis State Office Building
1000 SW Jackson St., Suite 540
Topeka, KS 66612-1367

Susan Mosier, MD, Secretary

Kansas
Department of Health & Environment

Phone 785-29
Fax 785-36
www.kdhe

Sam Brownback, Gov

FOR IMMEDIATE RELEASE
April 10, 2015

KDHE Office of Communica
communications@kdheks.gov, 785-296-

Potential Air Quality Impacts from Prescribed Burning

TOPEKA, Kan. - Kansans should be aware that weather conditions will be favorable for burning grasslands in the Flint Hills area of the state today, April 10 and Satu April 11. These burns can create air quality impacts when meteorological conditions do not provide for adequate dispersion of the pollutants formed by the burns. Air pollutants from the burns can affect persons in the Flint Hills and can be carried long distances to more populated areas. These burns are conducted to provide better forage for cattle and to help control invasive species such as Eastern Red Cedar and Sumac. Well planned and managed periodic burns can minimize fire safety dang and is a valuable tool for managing rangeland.

"While the potential exists for significant burning to occur throughout eastern Kansas, including the Flint Hills this weekend, we are hopeful that increasing winds on Saturday afternoon and a chance of thunderstorms on Sunday will limit the impact that the burning may have on downwind areas," said Doug Watson, meteorologist v the Bureau of Air.

Smoke is made up of a complex mixture of gases and fine particles produced when wood and other organic matter burn. The fine particles can get into your eyes and respiratory system, where they can cause health problems such as burning eyes, runny nose, and illnesses such as bronchitis. Fine particles and ozone can also aggravate chronic heart and lung diseases. Older adults and children are at highest risk for health problems especially those with underlying health conditions. There ways to reduce exposure to smoke during the burning season and the related health impacts. It is important to limit your exposure to smoke, especially if you fall into of the high-risk categories. Here are steps you can take to protect your health on days when smoke is present:

- Healthy people should curtail or avoid strenuous outdoor exercise.
- People with heart or breathing related illnesses should remain indoors.
- Help keep indoor air clean by closing doors and windows and running the air conditioner on 'recirculate' setting.
- Keep airways moist by drinking lots of water.
- Contact your doctor if you have symptoms such as chest pain, chest tightness, shortness of breath or severe fatigue.

KDHE has worked with many partners over the last few years implementing the Flint Hills Smoke Management Plan to address the air quality impacts that result from annual burning. The plan includes recommended burning practices to minimize and disperse the smoke produced by the fires. The plan was also the impetus for crea of a website, hosted by KSU Extension, which has a modeling tool to allow land managers to determine if meteorological conditions are good for dispersing smoke fro fires they are planning.

For more information about the burning in the Flint Hills, the Flint Hills Smoke Management Plan and the modeling tool, please visit www.ksfire.org.

###

At KDHE, our mission is to protect and improve the health and environment of all Kansans.

Through education, direct services and the assessment of data and trends, coupled with policy development and enforcement, KDHE will improve health and quality c life. We prevent illness, injuries and foster a safe and sustainable environment for the people of Kansas.

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City of Lincoln
Mayor's Office

2015 Media Releases

Date:
April 10, 2015
For More Information Contact:
Chris Schroeder, Health Department, 402-441-6272

Health Department Issues Health Advisory

The Lincoln-Lancaster County Health Department (LLCHD) today issued a Health Advisory for sensitive populations because of smoke from agricultural burning. Officials said the levels of smoke in the air are unhealthy for those with asthma, lung disease, other respiratory conditions or heart disease as well as older adults and children. LLCHD advises those at risk to stay indoors and avoid strenuous physical activity.

Chris Schroeder, Air Quality Supervisor with LLCHD, said southerly winds and the extensive burning in the Midwest, especially the Flint Hills area of Kansas, will likely expose people in Lincoln and all of Southeast Nebraska to unhealthy levels of smoke in the air.

"The forecast indicates that our community is likely to be impacted for several days," Schroeder said. "Smoke is made up of tiny particles and gases. When these are breathed into the lungs, they can cause asthma attacks, worsen chronic bronchitis and emphysema, and cause angina in some people with heart disease."

Residents are advised to keep windows and doors closed and use the "re-circulate" setting when using a vehicle air conditioner. Those who experience difficulty breathing, coughing, tightness in the chest or angina should contact a medical provider.

The LLCHD monitors air quality 24 hours a day, and the Air Quality Index (AQI) at lincoln.ne.gov (keyword: air) is updated daily. The AQI is expected to be "orange," meaning the air quality is unhealthy for sensitive individuals.

For more information, visit health.lincoln.ne.gov.

Douglas County Health Department - Health Department Concerned About Air Quality

Health Department Concerned About Air Quality

Friday, 10 April 2015 15:26

The Douglas County Health Department is advising people who have lung disease, respiratory disease, or a heart condition to be aware of possible smoke and particulates in the air during the weekend. The source of the problem appears to be fires in the Flint Hills area of Kansas, several hours south of the metro area.

The particulate matter could put the air quality index (AQI) in the range of "unhealthy for sensitive groups," with the hours of greatest concern expected to be Saturday and Sunday morning. It is suggested that individuals in the "unhealthy for sensitive groups" category shut windows and doors, and reduce outdoor activities.

Last weekend, on Sunday, it was possible to smell the smoke outdoors. Winds and possible thunderstorms should help clear out the air at some point this weekend.

The public can stay on top of the conditions by going online to www.enviroflash.info . Simply wait for the U.S. map to appear, then click on Omaha and zoom in. That page includes the forecast, and provides hourly updates.

Sensitive groups who should be aware of these conditions include: persons with heart and lung disease, older adults and children are at greater risk from the presence of particles in the air.

The effects of air pollution can be minimized by avoiding strenuous activity or exercise outdoors and by avoiding being outdoors for prolonged periods of time.

It is recommended that anyone who experiences any of the following symptoms should contact their health care provider immediately: repeated coughing, shortness of breath or difficulty breathing, wheezing, tightness or pain in the chest, palpitations, nausea, unusual fatigue or a light-headed feeling.

The air quality forecast can be viewed on the Douglas County Health Department's website at www.douglascountyhealth.com.

http://douglascountyhealth.com/archived-news/439-health-department-concerned-about-air.

APPENDIX B – Media Reports

http://www.omaha.com/news/metro/spring-burning-in-northeastern-kansas-lessens-omaha-air-quality/article_f0466772-dba5-11e4-a88e-db6ac74882f4.html

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PREVIOUS

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Spring burning in northeastern Kansas lessens Omaha air quality

By Kevin Cole / World-Herald staff writer Apr 5, 2015

The Douglas County Health Department issued an air quality alert because of smoke and particulates in the air from fires several hours south of the Omaha area.

Each spring, landowners in the Flint Hills area of northeast Kansas — from Wichita to Topeka — are allowed to burn dead grass. Josh Boustead of the National Weather Service's office in Valley said southerly winds are bringing smoke from the burn into southeast Nebraska.

"As we heat up during the day we should get more of a mix of breezes and it won't be quite so apparent," Boustead said Sunday. "We can expect some of the same conditions (Sunday night), and the smoke will probably be back (Monday)."

The particulate matter has put the air quality index in the range of "unhealthy for sensitive groups." Shutting windows and doors and reducing outdoor activities is suggested for individuals who may be in that category.

Sensitive groups include people with heart and lung disease; older adults and children are at greater risk from the presence of particles in the air.

"You can smell the smoke outside," said Russ Haden, a pollution scientist with the Douglas County Health Department.

The effects of air pollution can be minimized by avoiding strenuous activity or exercise outdoors, and by avoiding being outdoors for prolonged periods of time.

The public can stay on top of the conditions by going online to www.enviroflash.info. That page includes the forecast and hourly updates.

It is recommended that people who experience any of the following symptoms contact their health care providers: repeated coughing; shortness of breath or difficulty breathing; tightness or pain in the chest; palpitations; nausea; unusual fatigue; or a lightheaded feeling.

The air quality forecast can be viewed on the Douglas County Health Department's website at www.douglascountyhealth.com.

Second Air Quality Warning Issued In As Many Weeks

By: Matthew Smith - Email
Updated: Fri 6:21 PM, Apr 10, 2015

OMAHA Health officials have issued an air quality warning for Nebraska.

The affected counties include Douglas and Lancaster counties. People with asthma, lung disease and other respiratory or heart conditions should be advised that the conditions outdoors could effect them.

The notice applies to adults and children. Anyone with underlying health conditions tied to their lungs or heart are advised to stay indoors with doors and windows closed.

Lincoln-Lancaster air quality supervisor Chris Schroeder says the area will likely be blanketed in the smoke for several days.

The issue stems from smoky fires in the Flint Hills area of Kansas. That's several hours south of the Omaha-area.

WOWT NBC Omaha 3501 Farnam Street Omaha, NE 68131 (402) 346-6666 sixonline@wowt.com

Health Department Issues Air Quality Alert

Updated: Sun 11:56 AM, Apr 05, 2015

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An Air Quality Alert has been issued by the Douglas County Health Department due to smoke and particulates in the air. The source of the problem appears to be fires several hours south of the metro area.

The particulate matter has put the air quality index (AQI) in the range of "unhealthy for sensitive groups" Shutting windows and doors, and reducing outdoor activities is suggested for individuals who may be in that category.

"You can smell the smoke outside," according to Russ Haden, a pollution/lab scientist with the Douglas County Health Department. "Winds should clear some of it this afternoon."

Sensitive groups who should be aware of these conditions include: persons with heart and lung disease, older adults and children are at greater risk from the presence of particles in the air.
The effects of air pollution can be minimized by avoiding strenuous activity or exercise outdoors and by avoiding being outdoors for prolonged periods of time.

The public can stay on top of the conditions by going online to www.enviroflash.info . Simply wait for the U.S. map to appear, then click on Omaha and zoom in. That page includes the forecast, and provides hourly updates.

It is recommended that anyone who experiences any of the following symptoms should contact their health care provider immediately: repeated coughing, shortness of breath or difficulty breathing, wheezing, tightness or pain in the chest, palpitations, nausea, unusual fatigue or a light-headed feeling.

The air quality forecast can be viewed on the Douglas County Health Department's website at www.douglascountyhealth.com.

DOUGLAS COUNTY Health Department

County Health Officials Warn of Smoke from Ag Burning

APRIL 10, 2015 BY ASSOCIATED PRESS — 0 COMMENTS

LINCOLN, Neb. (AP) — Eastern Nebraska health officials have issued a warning about the potentially harmful levels of smoke in the air from agricultural burning.

The health departments in both Lincoln-Lancaster and Douglas counties issued a health advisory Friday for people with asthma, lung disease and other respiratory or heart conditions. Health officials say the source of the smoke is fires in the Flint Hills area of Kansas, several hours south of the Omaha metro area.

The notice applies to adults as well as children, and anyone with these health issues are advised to stay indoors with doors and windows closed.

Lincoln-Lancaster air quality supervisor Chris Schroeder says the area will likely be blanketed in the smoke for several days.

LINCOLN LANCASTER COUNTY HEALTH DEPARTMENT