Press Release:
June 5, 2017 For Immediate Release

Flint Hills Burns Cause Unhealthy Air in Manhattan Kansas

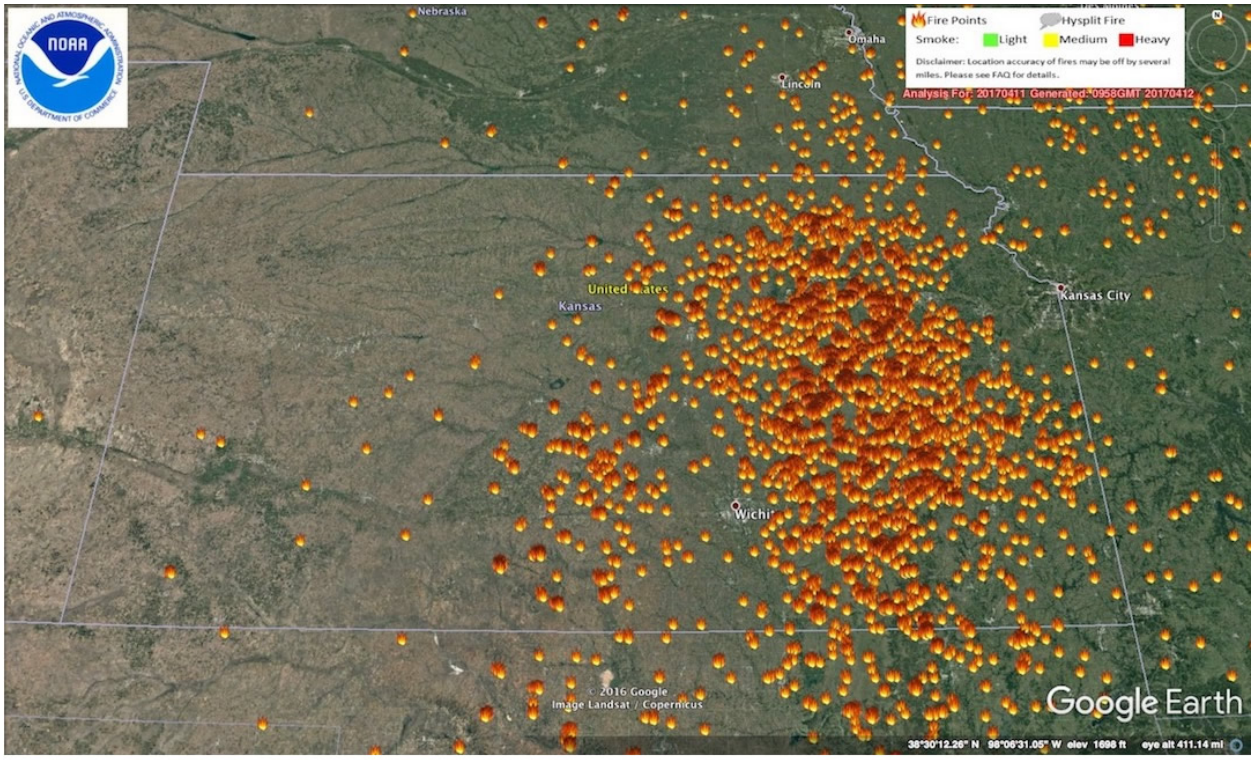
Portable air pollution monitors deployed this spring by the Kansas Sierra Club and members of the CleanAirNow Coalition indicate that the health of Manhattan residents is at risk during the Flint Hills burning season. Manhattan, home to Kansas State University, is the largest population center in Kansas directly in the path of smoke moving north.

The monitors showed PM2.5 fine particle levels well above the National Ambient Air Quality Standard (NAAQS) on April 7 and April 11, 2017. The results were consistent with levels measured in Lincoln, Nebraska the next day.

This wholesale burning has caused exceedances of the NAAQS for PM2.5 and/or ozone at monitors in Lincoln or Omaha, Nebraska this year and in each of the previous three years. There are no continuous PM2.5 monitors between Kansas City, Ks. and the Cedar Bluff Reservoir monitor near Hays, a distance of some 280 miles, capable of monitoring a northerly moving smoke plume in Kansas.

"Short term exposure to particulate matter air pollution can be deadly. It can trigger asthma attacks, and has been linked to strokes, heart attacks, and other serious health effects," says Eric Kirkendall, Director of the Diesel Health Project and member of the CleanAirNow Coalition in Lawrence, Ks.*

"A lot of people in this town and at the University are at risk," says Manhattan resident and host of one of the monitors, Carol Barta. "We need a study of the cases seen at hospitals & clinics in Manhattan and elsewhere on heavy burn days like we recently experienced."



Big Burn in the Flint Hills, April 11, 2017

The full report on the monitoring project may be found at this link.
http://kansas.sierraclub.org/press-release-and-report-flint-hills-burns-cause-unhealthy-air-in-manhattan-kansas/

The groups are calling for KDHE to improve their ineffective 2010 Smoke Management Plan and to install continuous PM2.5 monitors to assess the health risks to small town and rural residents near the Flint Hills. They note that, unlike Kansas, Oklahoma has installed ten continuous PM2.5 particle monitors throughout the state connected to EPA's AirNow alert system.

"State officials and stakeholders in the Flint Hills seem to think this problem will go away if they ignore it long enough," says KSU Professor and Sierra Club member, Scott Smith. "We think that the good people of Kansas can get together with officials and fix it."

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* More information on fine-particle health impacts is available from EPA's ***AirNow*** (https://www.airnow.gov/) air quality alert system.

REPORT:

Citizen Monitoring of the Spring of 2017 Flint Hills Burn

Introduction

Except in drought years, Flint Hills landowners set fire to some 2 to 3 million acres of grasslands in late March and April to stop the spread of woody plants, stimulate fresh growth of grasses, and increase the weight gain of their cattle. Extensive burning in a short window of time often causes exceedances of the National Ambient Air Quality Standards (NAAQS) for ozone smog and/or fine particulate (PM2.5) in Kansas and surrounding states. Such exceedances have occurred in Nebraska this year and in each of the previous three years.

Exposure to high levels of these pollutants, for periods as brief as 24 hours or less, is known to cause respiratory difficulties in sensitive individuals, including increased use of medications and visits to emergency rooms and even hospitalizations.

The USEPA set up the ***AirNow*** system to warn US citizens of unhealthy air on a near real-time basis. However, the ***AirNow*** system is dependent on input from *continuous* ozone and PM2.5 monitors in any affected area.

The state of Kansas lacks any continuous PM2.5 monitors in the vicinity of the Flint Hills, and the only ozone monitor near the area, north of Wichita, is in Topeka. An ozone monitor near Manhattan, Ks. was closed in 2013 upon the urging of the Kansas Department of Health and Environment (KDHE).[1]

When the wind blows from the south, the smoke plume must reach the continuous monitors in Lincoln, Nebraska, generally the next day, to be detected. There is no way for Kansans to use ***AirNow*** to reduce exposure to the heavy smoke generated every year downwind of the burns.

In their 2010 Smoke Management Plan (SMP) for the Flint Hills burning, the Kansas Department of Health and Environment (KDHE) announced their intent to conduct an extensive study of the health impacts of this activity, but never followed through. Without continuous monitors it is difficult, if not impossible, to assess the actual exposure of the residents in the path of the plume, a basic requirement of a scientific health impact study.

Purpose of the Citizen Monitoring Program

The purpose of the monitoring effort described in this report is to demonstrate the need for a serious program by the state of Kansas to measure the exposure of rural and small town residents to smoke and other pollutants from the annual Flint Hills burning. The Kansas Chapter of the Sierra Club has frequently informed KDHE of this deficiency and requested action. Since KDHE has taken none, the Chapter has partnered with the non-profit Diesel Health Project and the CleanAirNow Coalition to launch a citizens monitoring project.

The mission of the CleanAirNow Coalition is to improve air quality in Kansas City and the surrounding region, particularly in communities suffering the greatest health burden, and to prevent and mitigate disease caused by air pollution. The Diesel Health Project, a Kansas non-profit with an environmental health focus, conducted extensive monitoring around the BNSF railroad yard in Kansas City, Ks. in 2014 and 2015. The group was given two portable, fine particle filter monitors after the completion of that program and these were employed on the current project. The Kansas Chapter of the Sierra Club covered most of the expense.

Method

PM2.5 was measured by two MiniVol Portable Tactical Air Samplers manufactured by Airmetrics of Springfield, Oregon. These two units were donated last fall to the Diesel Health Project by Global Citizens Monitor, Inc. and immediately shipped to Airmetrics for recalibration. We also purchased additional parts, especially a new battery, to enable back-to-back tests of 24-hour duration. The units were tested without incident in January and February of 2017 for six 24-hour periods for both PM2.5 and elemental carbon in potential "hot spots" near the urban center of Kansas City, Kansas.

We determined that Manhattan, Kansas would be a good location for monitoring the Flint Hills burn since it is directly downwind of the bulk of the burning activity and in line from south to north[2] with Lincoln, Nebraska where we could check in with Lincoln's BAM continuous PM2.5 monitor. Two experienced members of the Sierra Club volunteered to host and operate the units in the city.

Representatives of both the Kansas Chapter (Craig Volland) and CleanAirNow (Eric Kirkendall) traveled to Manhattan to deliver the monitors. Also Leticia DeCagny, who had mounted and operated identical monitors for the BNSF rail yard project, came along to conduct the training in their use.

One monitor was mounted off the back deck of Dr. Scott Smith's home on the north side of Manhattan near the Kansas State University campus, and the other unit was located in the back yard of Carol Barta on the south side of the city.[3] The air intakes were located at about six feet

above ground. The pre-weighed filters were shipped directly to Dr. Smith by Chester Labs of Portland, Ore. Further procedural details may be found in the Appendix to this report.

The Results

Burn events. The scale of burning did not always correspond to our expectations, usually due to strong winds. On some days there was little smoke to monitor. One can view the NOAA interpretation of satellite observations by clicking on this link: NOAA Kansas Fire and Smoke Maps (https://drive.google.com/drive/folders/0ByaDcI-8M5aXb0cxblUxTWU2U0k). The vast majority of the burning this year occurred in the eight-day period from April 6 through April 13. The burns were especially intense on April 7 and April 11. April 6 and April 10 were also big burn days, but the wind blew from the west and north. So we did not monitor on those days.

Quality of data. We obtained 23 valid results on 13 days.[4] One sample had to be discarded due to a malfunction of the air pump setting possibly due to heavy rain overnight. In another case a machine malfunction prevented the operator from setting the appropriate pump rate.[5] We obtained valid results on nine days when both units were running simultaneously, and the values were consistent, within 10% of each other on average. Only one pair varied more than 15%.

Bad air in the City of Manhattan. On the heaviest burn days, residents of the city were exposed to PM2.5 fine particle levels far above the NAAQS. On April 7 the monitors recorded PM2.5 levels of 52.3 and 45.5 ug/M3 respectively. On April 11 the north monitor recorded a value of 60.3 ug/M3.[6] The PM2.5 standard is 35 ug/M3 over 24 hours. On a third day, April 12, the north monitor recorded a value of 35.4 ug/M3, which does not officially exceed the standard only because the EPA protocol is to round down anything above the integer when comparing to the NAAQS. The south monitor recorded 30.4 ugM3 that day.

On the elevated PM2.5 days there was a modest gradient across the city from north to south, but on low PM2.5 days the gradient was mostly from south to north. There was insufficient data to draw any conclusions in this respect.

Comparison to the Lincoln, Nebraska PM2.5 Monitor. On heavy burn days in the Flint Hills, with a southerly wind, the resulting smoke plume envelops Lincoln about 12 hours later. The plume moving north from the Flint Hills typically approaches Lincoln about 6 PM of the Kansas burn day and dissipates late morning of the following day. Thus the highest 24-hour rolling average PM2.5 value may not correspond to the standard midnight to midnight value recorded for regulatory purposes.

On days when heavy burns occur back-to-back in Kansas, the standard 24-hour period PM2.5 may be higher than the maximum rolling average associated with the first burn day in Kansas. That's because the monitor picks up before midnight the initial high values from the second heavy burn. That appears to have occurred on April 12 in

Lincoln from burns in Kansas on April 11 and 12. In any event, our results are of the same scale as those measured the next day in Lincoln after big burn days in Kansas.[7]

April 7: big burn in Kansas yields PM2.5 values of 54.3 and 47.3 ug/M3 in Manhattan;

April 8: while 43.7 ug/M3 @24 hours (midnight to midnight) is measured in Lincoln;

a 55.6 ug/M3 maximum rolling 24 hour average value is associated with the

April 7 Kansas burn;

April 11: big burn in Kansas yields 63.9 ug/M3 in Manhattan;

April 12: moderately large burn in Kansas yields 36.4 and 31.2 in Manhattan;

April 12: while 49.6 ug/M3 @ 24 hours midnight to midnight is measured in Lincoln;
a 39.9 ug/M3 maximum rolling average value is associated with the April 11 burn in Kansas;

April 13: while 26.7ug/M3 @ 24 hours (midnight to midnight) is measured in Lincoln,
a 40.9 ug/M3 maximum rolling average value is associated with the April 12 Kansas burn.

Discussion

Our monitoring program has demonstrated that Manhattan, Kansas was heavily impacted by the 2017 Flint Hills burning of grasslands. While KDHE sent out an air quality alert on April 6, prior to the big burn of April 7, they did nothing we are aware of to warn people specifically about the April 11 event. Neither the current smoke management system nor a press release is capable of predicting the scale of any health impacts. There is no means whereby the scale of exposure of Kansas residents can be assessed for the purpose of future studies.

There are no continuous monitors connected to EPA's *AirNow* warning system anywhere near Manhattan. Manhattan is a city of 56,000 people (2016) and some 25,000 students (2014) at Kansas State University. The City cannot rely on the monitors in Lincoln, Nebraska, connected to the *AirNow* system, to warn its citizens of heavy smoke, because the Lincoln monitors will not detect the smoke until late in the day.

Kansas operates only two continuous PM2.5 monitors, one in Kansas City, Ks. and one 280 miles to the west near Hays. KDHE has plans to place one in Wichita. In contrast, Oklahoma operates *ten* continuous PM2.5 monitors throughout the state including two that are positioned in Ponca City and Copan to immediately detect heavy smoke from the Flint HiIls burning.[8]

Current EPA monitoring network rules are out of date. States are required to focus almost entirely on area measurement of air quality in large municipalities related to industrial and transportation sources. This policy overlooks both local hotspots in urban areas, such as rail yards, ports and near-road concentrations, and various situations in rural areas, such as prescribed burning and poor air associated with huge agricultural operations like CAFOs.

Conclusions

Two Portable PM2.5 particle monitors provided to local citizens by the Diesel Health Project, CleanAirNow and the Kansas Chapter of the Sierra Club have demonstrated that the residents of Manhattan, Kansas and nearby rural areas were heavily exposed to dangerous levels of fine particulates as a result of intensive burning of grasslands in the Kansas Flint Hills in April of 2017. The data obtained in Manhattan were consistent with PM2.5 exposures detected the next day by the continuous monitor in Lincoln, Nebraska, some 120 miles to the north. However, that monitor cannot be relied upon to warn Kansans of an imminent air quality threat nor provide adequate exposure data for the health impact studies that KDHE had once planned to perform in the state.

It is imperative that KDHE improve its smoke management plan to reduce these exposures. KDHE must also set up continuous monitors not only near Manhattan but also elsewhere in the state threatened by heavy smoke from the burning. These monitors should then be connected to EPA's *AirNow* air quality alert system. The EPA does not prevent states from installing monitors wherever they wish and provides grants for that purpose. Oklahoma received a grant from EPA to establish its extensive network of continuous monitors. KDHE should follow their example.

Notes.

1. Monitor closing: http://kansas.sierraclub.org/shutdown-of-the-konza-prairie-ozone-monitor/
2. April, 11, 2017 NOAA smoke map: https://drive.google.com/file/d/0ByaDcI-8M5aXNWxUdnM2Y1B5cGM/view?usp=sharing
3. Monitor locations: https://drive.google.com/file/d/0ByaDcI-8M5aXanEwbjlSVUM4S0U/view?usp=sharing
4. Results: https://drive.google.com/file/d/0ByaDcI-8M5aXZWlMSzMxb29GRFE/view?usp=sharing
5. Monitoring on March 16 at the south unit provided some evidence of impact from local burning. The operator saw burning on the nearby Konza Prairie that morning. The unit recorded an elevated PM2.5 value but difficulty with the setting of the air pump resulted in an air volume of 9.8 cubic meters instead of the normal 7.2. The increased flow through the impactor would have resulted in a smaller particle size cut-off, at about 1.9 ug in this case. So the result was 26.8 ug/M3 of PM1.9. The unit was not started until 12:37 PM due to a work conflict. We excluded this result from the database.
6. The south unit did not operate on April 11 because the operator was out of town.
7. The Lincoln PM2.5 monitor is connected to the ***AirNow*** system and is not operated for regulatory purposes. It's data is in terms of actual air flow conditions. Thus the Manhattan data used for this comparison is also in terms of actual not standard temperature and pressure.
8. http://www.deq.state.ok.us/aqdnew/monitoring/airvision/pm.PDF

Appendix:

Method (continued)

Subsequent to the training in Manhattan, Volland examined weather data each day to estimate when conditions would correspond to recommendations (http://www.ksfire.org/) provided to Flint Hills landowners by KDHE and its advisors. A day ahead, Volland consulted both Weather Underground and the National Weather Service's detailed tabular forecasts for both Manhattan and Emporia to assess wind and atmospheric mixing height data.

When conditions were predicted to be favorable, and usually when the wind was expected to blow from the south during the daylight burn window, Volland would calculate a setting for the monitor air pumps. The MiniVol monitors are designed to pump air through the filters at a rate of 5 liters per minute, or 7.2 cubic meters over 24 hours. However the pump is affected by actual temperature and pressure during the 24-hour duration of the test, and by its calibration values.

On each appointed day the operators would insert the filters, set the air pump speed and program the units to run for 24 hours. The units were usually set to start at 7 to 8 AM on most days, depending on the operators' work schedules. The operators would record start and stop timing, air pump settings and weather conditions for each sampling event on a field data sheet. The units

shut off automatically at 24 hours, allowing the operators some leeway around their work schedules. The filters were removed and placed in a freezer pending shipment back to the lab.

The two units were run nearly simultaneously on most days in order to increase confidence in the resulting data. There was also the opportunity to detect any gradient in pollution across the city. This was a possibility since the unit to the south was located near the Konza Prairie where burning is conducted every year for research purposes. At the end of the program all the filters were shipped together overnight in cold packing to Chester Labs where they were re-weighed to determine the net weight representing material captured during the sampling event. Most of the filters were utilized within 30 days, and all the filters were used, and analyzed by Chester Labs, within 60 days.

After the results were received from Chester labs it was necessary to recalculate the pumped volume according to conditions actually experienced during the 24-hour period. An average of hourly data from the weather history maintained by Weather Underground was used for this purpose. Finally the concentration was calculated as the net weight divided by the air volume. This value was adjusted to standard temp.