Argentine/Turner Diesel Exhaust Air Pollution Monitoring Final Report

A Report by Global Community Monitor
for the
Argentine/Turner Good Neighbor Committee
and the
Diesel Health Project

June 24, 2015

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Executive Summary

The Argentine Rail Yard, operated by Burlington Northern Santa Fe (BNSF) Railway, is situated south of the Kansas River. The BNSF facility is a 780-acre rail yard with 60 sorting tracks and a diesel engine maintenance shop. Each day, the facility connects and disconnects approximately 2000 freight cars to diesel engines for cross-country transportation of freight.

With support by the Diesel Health Project, Global Community Monitor, Kansas Sierra Club and community organizer Richard Mabion, and with funding from the Kresge Foundation, the Argentine/Turner Good Neighbor Committee conducted a community air monitoring project to measure the amount of diesel exhaust pollution in neighborhoods bordering the BNSF Argentine Rail Yard.

The Good Neighbor Committee conducted monitoring for approximately 15 months. Over that period of time they monitored air quality in the yard of many homes, collecting 47 samples that were analyzed for Elemental Carbon (EC), a marker for diesel exhaust pollution.

In **twenty-one** of the 47 daily measurements (45%), EC levels exceeded 0.838 $\mu g/m^3$. ***On these dates, persons spending time outdoors at this location would be subject to an elevated risk of cardiovascular and respiratory hospitalizations on the day of exposure.*** In **seven** of the 47 daily measurements (15%), EC levels also exceeded 1.36 $\mu g/m^3$. Therefore, ***on these dates, persons spending time outdoors at this location would also be subject to an elevated risk of cardiovascular mortality two and three-days post exposure.***

In addition, five more tests were done between March 26, 2015 and May 11, 2015 by the Sierra Club. Those results support BNSF's contention that the air pollution emitted from the area formerly occupied by an intermodal hub has been reduced. These tests also pinpoint the serious diesel exhaust air pollution caused by the maintenance facility.

Conclusions:

1. The BNSF locomotive maintenance shop and surrounding outdoor staging and locomotive testing area is the most dangerous source of emissions in the rail yard.

2. Residents within 300 meters of the rail yard, especially those near the maintenance shop, are at risk of exposure to dangerous levels of diesel exhaust pollution.

3. Exposure appears to be increased during periods of calm and very light winds regardless of wind direction, though this effect is difficult to distinguish from that of close proximity.

4. Community air quality testing for EC/OC ultrafine hazardous particles in Argentine/Turner should continue, in order to monitor dangerous air pollution from the BNSF rail yard.

5. The Kansas Department of Health and Environment (KDHE) and U.S. Environmental Protection Agency (EPA) should monitor ultrafine particles on a regular basis and share the data with the public.

6. There is evidence that the closure of the old intermodal facility at the west end of the yard has resulted in reduced exposure to neighbors. However, the monitoring sample size in that area is too small to be conclusive. Additional monitoring is needed.

Recommendations:

1. To enclose in a building the area where locomotives being overhauled at the maintenance facility are tested. To place air handlers and scrubbers on the roof of that building to treat the exhaust, thus limiting exposure to dangerous diesel exhaust by both employees and neighbors.

2. To develop a plan to move toward zero emissions beyond their fenceline as soon as possible, and to have no locomotives with greater than Tier 3 emissions within three years. To achieve this BNSF will need to put in place an accelerated schedule of upgrades and retrofitting of switch engines. (We assume BNSF is using low sulfur fuel that will allow the upgrade.)

3. To install a real-time fence-line monitoring system to check for black carbon, elemental carbon or other diesel markers.

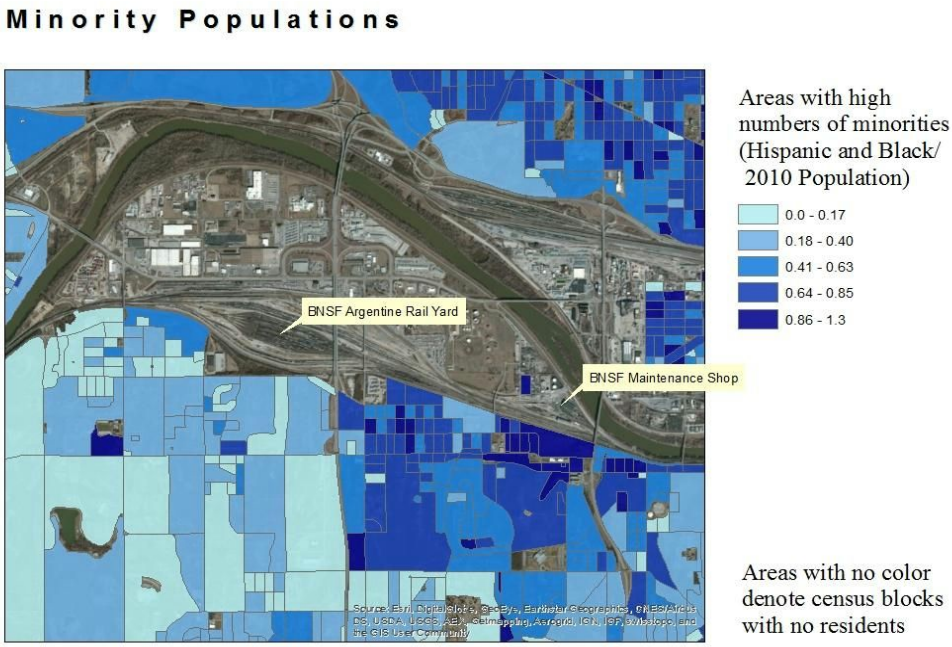
4. To keep the Good Neighbor Committee informed on a regular basis of progress in lowering diesel particle emissions.

Background

The Burlington Northern Santa Fe (BNSF) Argentine Rail Yard is a 780 acre multi-use facility situated south of the Kansas River in Kansas City, Kansas. One of the largest rail yards in the U.S., it includes a 60 track classification yard, 20 receiving and departure tracks, a very busy locomotive maintenance and inspection facility, and until recently, a small intermodal facility. The classification yard handles approximately 110 trains per day, each with 2-3 locomotives.

The rail yard is bordered on the south by the Turner and Argentine communities. Neighborhoods nearest the rail yard are heavily polluted by diesel exhaust air pollution.

Kansas City, Kansas is one of the most racially and ethnically diverse cities of its size in the State of Kansas. In 2010, its population was approximately 50% White, 27% Black or African American, and 28 % Hispanic. KCK is the poorest city in the metropolitan area, with over 28% of residents living below the poverty level. In 2010, median household income in KCK was $33,011, compared to the metropolitan average of $53,919. The map below illustrates the high percentage of minority residents south of the BNSF rail yard.



With support by the Kansas Sierra Club, community organizer Richard Mabion, and Global Community Monitor, and with funding from the Kresge Foundation, the Argentine/Turner Good Neighbor Committee conducted a community air monitoring project to measure the amount of diesel exhaust pollution in neighborhoods immediately adjacent to the BNSF Argentine Rail Yard.

This citizen science air quality monitoring was initiated by the Diesel Health Project. The Argentine/Turner Good Neighbor Committee is composed of residents of the Argentine and Turner neighborhoods of Kansas City, Kansas.

Voices from the Community

BNSF worker

I work about 40 – 50 ft away from the diesel locomotives and my clothes are always saturated with diesel fumes, especially when it's cold it is very dense. I don't even get around oil and grease. I change my clothes at work and I even have to seal up my street clothes in the locker because if not then my clean clothes will also be filthy.

They provide showers, washers and dryers to wash clothes and there is no way I am going to go home without changing into my street clothes. I don't know how people can get in their vehicle like that. One time I was in a hurry on my way home and my family smelled me before I even walked into the door.

There is constantly an average of 60 locomotives idling all the time. They do have an autostart where when if the engines idle a certain amount of time, it will shut down as long as it's not freezing. The longer the train is the more horsepower it uses and that causes more pollution. The locomotives just put out a lot of pollution.

Sometimes the shop will get overwhelmed with locomotives from other cities as we have high traffic and are centralized. I wish they would distribute to other shops so that there would be less exposure around. The shops around here deal with repairs that take about a couple of days. They send off to Topeka if they need major work.

I once visited a friend that lived in the area up the hill, and I told him it smelled just like work. He said he smells it all the time but wasn't sure what it was. Yup, that's the smell of diesel. My heart goes out to the people who live in the area. I really feel for them. I wouldn't want a home close by even if it was given to me. Not everyone is fortunate enough.

Loretta Escobar

We live a block away and we can see the Rail yard from our front lawn. We can hear the locomotives and you can feel our house shake. I now have asthma and allergies and I take daily medications. I didn't have these problems until I moved to this area. Since knowing more about the project and the effects of the diesel pollution in the area, I don't go outside as much. Please see your doctor if your breathing starts to become a problem ASAP.

Cathy Pacheco

We live at the end of the block close to the railroad tracks. We hear locomotives 3 to 4 times a day including a lot at night and early in the morning. We do have cracks in our ceiling from the shaking we feel. My husband has Parkinson's and I have asthma. We cannot have any windows open because we do not want to let the bad air in. I don't get to enjoy the outside of my home, but only to plant my flowers. If I want to go relax outside, I have to go to my daughter's house. I also think it has lowered our property value.

Community Based Monitoring

Regulatory and environmental agency personnel often are not available at all hours to arrive on site and take samples during a pollution incident. Community led monitoring provides an opportunity for residents to document pollution incidents and take samples in addition to contacting agency personnel. Community pollution incident records, referred to as “pollution logs,” filled out by impacted community members insure that records are maintained beyond regular business hours.

Community led monitoring engages the impacted community in record maintaining, site identification, operation of monitoring equipment, filling out necessary forms and shipping of the sample.

GCM trained the members of the Argentine/Turner community and other impacted community members to keep a record of pollution incidents identifying the residents’ names, location, the nature and duration of the incident, the wind direction, health effects or property damage and how the incident was addressed - by a call to the regulatory agency, the polluting company or informative calls to other neighbors. Community members are also encouraged to take pictures and or use video camcorders to catch a visual image of the pollution.

The community input, through pollution logs and community meetings, helps determine potential sampling locations by better understanding what the day-to-day experience is and the nature of the pollution problem in relation to wind direction, pollution sources and neighborhood location. The areas with the most consistent pollution and records of the pollution are referred to as “hot spots.” The majority of the sampling was conducted in the “hot spot” areas.

The Training:

GCM staff held a 4 hour orientation and hands-on training in November, 2013 in Turner with homeowners interested in having outdoor air quality testing done on their property, as well as other interested parties. The training included hands-on training on how to set up and use the Airmetrics MiniVol Portable Air Sampler, and quality control, and in assurance procedures for logging results and for filter use, storage, and shipment.

Training included::

- An introduction to the monitor and its features.
- How to assemble the monitor, including how to attach the battery pack.
- How to assemble the intake nozzle assembly, how to distinguish the PM 2.5 from the PM10 assemblies, and what particle diameter assembly to use for this project.
- How to load the filter into the assembly without contaminating it in a clean environment. Sterile gloves are used and filters are loaded indoors to prevent contamination prior to testing.
- How to fit the nozzle on the pump.
- How to make sure the monitor is properly calibrated to ensure 5-liter/minute airflow.
- How to program the monitor to ensure it runs for a complete 24 hour cycle, including waiting and listening to ensure the pump starts up as programmed.
- How to remove the filter when the monitoring period is over—again using sterile gloves and conducting this operation indoors in a clean environment—and immediately placing the filter in the clean sterile holder it was shipped from the lab in.
- How to ensure proper custody by entering key information on the laboratory control sheet including: sample location, date and run times, relevant observations about wind direction, strength, etc., and signing and retaining a copy of the control sheet.
- Proper record keeping using field logs and chain of custody forms.
- All aspects of good Quality Control/Quality Assurance practices.

Volunteers were also provided with a copy of the MiniVol manual, written and updated by Airmetrics.

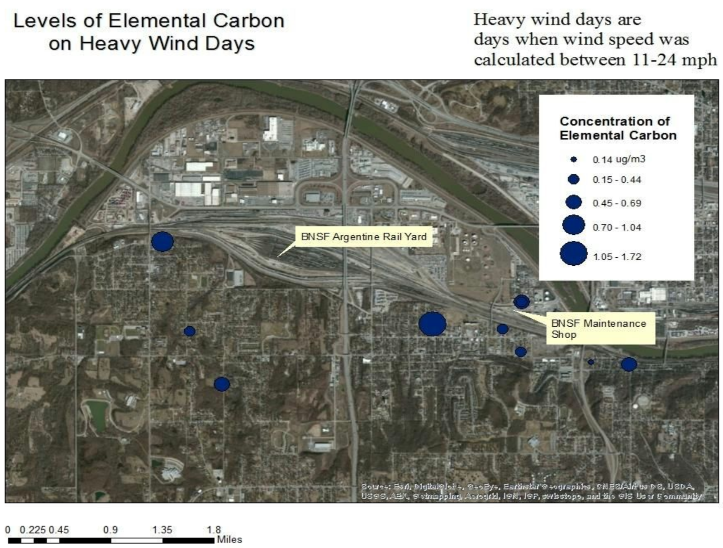
Samples were packaged with a field log data sheet, delivered to a United Parcel Service (UPS) or US Postal Service employee who signed the control sheet ensuring an unbroken chain-of-custody, and then mailed to Chester LabNet in Oregon for analysis using EPA-approved methods. Raw data sheets of the metals found in the samples are generally available within 10-15 business days.

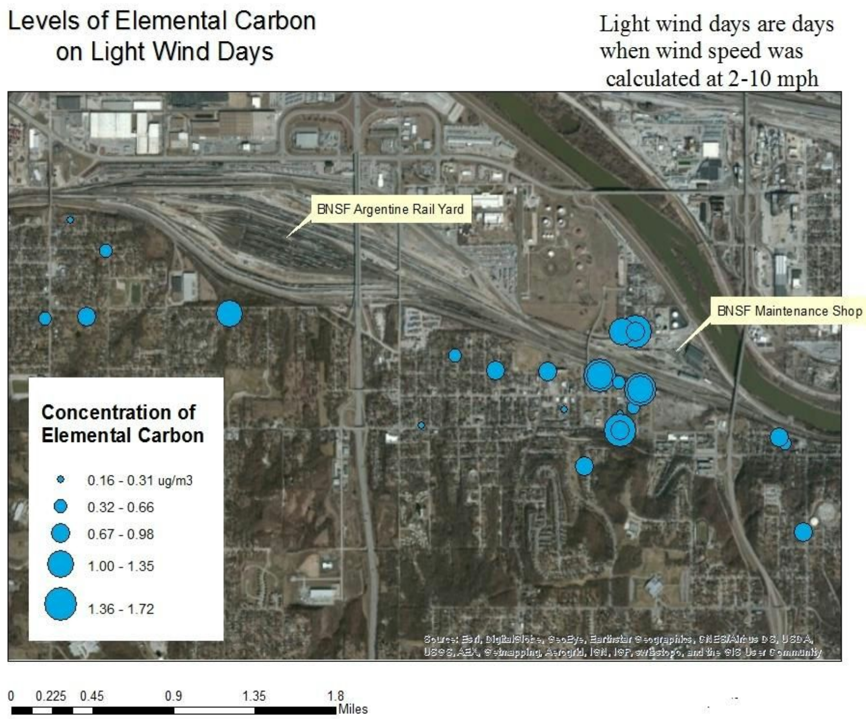
In addition, volunteers had been instructed in how to document key monitoring variables, such as wind speed and direction, whether odors/dust are present, etc. and how to enter this information into a field log to be added to the laboratory data.

GCM worked closely with volunteers to ensure that samplers followed the Standard Operating Procedures and followed strict Quality Control/Quality Assurance measures in all monitoring activities. In addition, ongoing technical assistance through constant communication and support from GCM and the chemical analyst were a key part of the project.

Determining What to Monitor for:

Given the close proximity of the communities to the rail yard, GCM and community leaders chose to monitor for particulate matter 2.5 (PM 2.5), Elemental Carbon/Organic Carbon (EC/OC), which is a test for diesel soot; and forty heavy metals (XRF).





Sampling Equipment, Protocols & Project Design:

Standard Operating Procedures were developed and implemented in the monitoring project.

Samples for this report used a variety of standard and accepted methodologies by a certified laboratory for analysis. Particle samples were subjected to analysis for concentrations of PM 2.5 by pre and post weighing analysis by Chester LabNet in Oregon. A portion of these samples were also subjected to analysis for metals by X-ray refractory technology (XRF).

In addition, other filter samples were analyzed for concentrations of diesel particulates by NIOSH method 5040 as Elemental Carbon as compared to Organic Carbon (EC/OC).

The Monitor:

Various environmental agencies throughout the country, including the U.S. Environmental Protection Agency, recommend that a MiniVol Portable Air Sampler produced by Airmetrics be employed to monitor for particulate matter. The MiniVol provides accurate and precise results, is easy to use, and can be moved from location to location, allowing for a broader

assessment of how toxic air contaminants might be distributed in the Argentine and Turner areas.

The MiniVol Portable Air Sampler samples ambient air for particulate matter (PM10, PM 2.5 or total suspended particulates -TSP) and/or non-reactive gases (CO, NOx). Airmetrics and the US EPA jointly developed the patented low-flow technology used in the MiniVol. While not a US EPA Federal Reference Method (FRM) sampler, the MiniVol provides results that closely approximate reference method data. Affordable and portable, the MiniVol is ideal for saturation studies, emergency response situations, fugitive emissions, prescribed burning sampling, and urban air quality studies.

The MiniVol is basically a pump unit that pulls air through a filter holder assembly, where particle size separation occurs by impaction. The flow of air can be adjusted and, in this case, has been set at 5 liters/minute. The particulate matter is collected on a 47mm filter. The filters are weighed pre and post exposure by a microbalance, accurate to one microgram, to determine the particulate concentration. The MiniVol does not provide any real-time readout. Samples are sent to a lab that utilizes EPA approved methods for analysis.

The MiniVol features include a seven day/six run programmable timer, an elapsed time meter, low flow and low battery shut-offs, and operation from rechargeable battery packs. The MiniVol can sample for only one size of particulate at a time and can sample for PM10, PM2.5 or TSP depending on the nozzle attachment used.

At the end of a particulate sampling period, the filter holder and battery pack are replaced by a second filter holder and a second battery pack (two of each come standard with a new MiniVol). Once a sample is collected, the exposed filter is sent to the lab for post-exposure weighing and analysis and a fresh, pre-weighed 47mm filter is placed into the filter holder for the next sample collection. Recharge of the spent battery is accomplished in about 16 hours using a universal transformer connected to a wall circuit. At certain sampling locations electrical power is available and the MiniVol is simply plugged in during sampling periods.

Prior to leaving the vendor’s shop, each MiniVol sampler is calibrated using a Laminar Flow Element and a calibration curve traceable to NIST is included with each new sampler. The manufacturer requires an annual recalibration test to ensure Quality Control/Quality Assurance. The monitor used in this report was recalibrated by the manufacturer prior to commencement of the project.

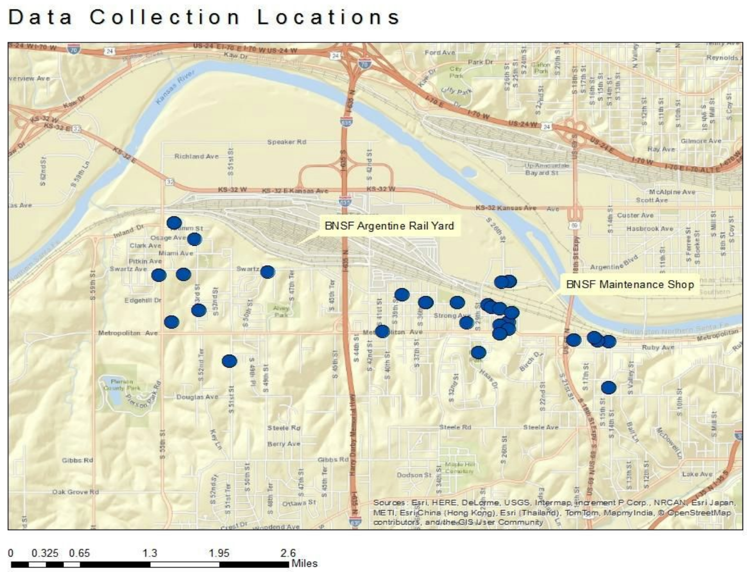
Sampling Locations:

The community identified potential locations for the air monitors to be placed. Volunteers were trained and instructed in how to determine whether locations meet EPA siting criteria. All potential locations were visited prior to actual sampling to ensure they were not obstructed, that the monitor could be placed in a secure location, and that the site met the location criteria just described.

Volunteers were trained and instructed in how to determine when wind conditions were right and how to make an assessment, at the end of the monitoring period, about the consistency of the winds during the previous 24 hour period. While it is typical for wind direction to shift during a normal 24 hour period so that some of the time the wind may not be coming from the direction of the polluting location, ideal samples involved monitoring when the monitor was located downwind for most of the monitoring period.

Additionally, lower wind speeds were preferred to ensure monitoring was conducted when maximum particulate fallout could be expected.

Trained community volunteers collected 24-hour filtered air samples in the vicinity of the Argentine Rail Yard. This image depict the location of representative sampling locations and their proximity to the Argentine Rail Yard.



Discarded Samples

The data from samples that did not meet the above Standard Operating Procedures were not included in the final report.

Analysis of Data by third party

GCM and community leaders sent the raw data sheets, chain of custody and field logs from the lab to Mark Chernaik, Ph.D., a third party expert, for calculation of 24 hour concentrations of PM 2.5, diesel particulate matter and metals.

Dr. Chernaik helps attorneys and citizens make effective use of scientific information pertaining to the environment. Dr. Chernaik received a Bachelor of Science degree in Biochemistry from the University of Massachusetts at Amherst and a Ph.D. in Biochemistry from Johns Hopkins University. His work has been published in the Proceedings of the National Academy of Sciences, U.S.A, and the Journal of Biological

Chemistry. He received a law degree from the University Of Oregon School Of Law in May 1993.

Dr. Chernaik provided his expert opinion concerning the potential sources of each of the air pollutants in the data as well as potential health implications from exposure to these compounds.

Lab Analysis Findings and Conclusions

Not including three field blanks, the air quality data consists of 66 air samples collected over a period of slightly more than a year – from November 2, 2013, to January 19, 2015. Nineteen of the 66 samples were analyzed for fine particulate matter ($PM_{2.5}$) by gravimetric analysis. The remaining forty-seven samples were analyzed for organic carbon (OC), elemental carbon (EC) and total carbon (TC) content by X-ray fluorescence (XRF).

According to Dr. Chernaik:

> *"Overall, seven of sixteen EC levels in filtered air samples collected since the beginning of the project in November 2013 are above a level associated with a short-term health risk. Notably, the seven filtered air samples with EC levels associated with a short-term health risk are generally closer (within 200 meters) to the BNSF railway facility than samples with lower EC levels, which were generally further (more than 1000 meters) from the BNSF railway facility.*
>
> *In twenty-one of the 47 daily measurements (45%), EC levels exceeded 0.838 µg/m^3. On these dates, persons spending time outdoors at this location would be subject to an elevated risk of cardiovascular and respiratory hospitalizations on the day of exposure.*
>
> *In seven of the 47 daily measurements (15%), EC levels also exceeded 1.36 µg/m^3. Therefore, on these dates, persons spending time outdoors at this location would also be subject to an elevated risk of cardiovascular mortality two and three-days post exposure".*

Vehicle exhaust, primarily diesel exhaust, is the predominant source of EC in ambient air.

- When EC levels are above 1 microgram per cubic meter (µg/m^3), then one can conclude that this location is an area impacted by diesel engine emissions.[1]
- When 24-hour EC levels at a location are above 1.36 µg/m^3, then they are high enough to be associated with an excess risk of cardiovascular mortality two and three-days post exposure.[2]

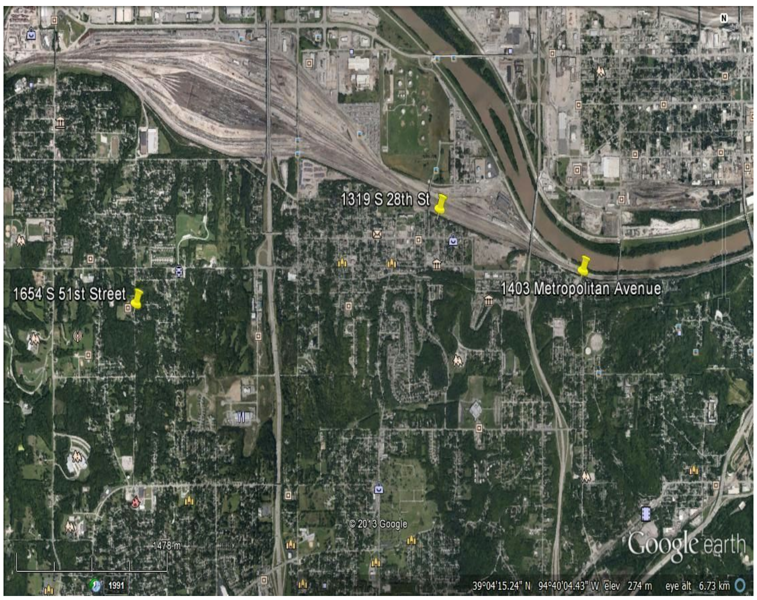
[1] Even in urban areas, levels of EC in air samples almost never exceed 1 µg/m^3 unless the sample is within a few hundred feet of road traffic. See: "Traffic emissions of elemental carbon (EC) and organic carbon (OC) and their contribution to PM2.5 and PM10 urban background concentrations (figures 2-12 and 2-13 on page 25)." http://www.mnp.nl/bibliotheek/rapporten/500099011.pdf

[2] In 2008, scientists from the California Office of Environmental Health Hazard Assessment (OEHHA) published a study about the relationship between cardiovascular mortality and the chemical composition of pollutant levels in ambient air in California. These scientists examined the relationship between cardiovascular mortality and the interquartile range (IQR = the difference between the third and first quartiles) of EC levels. The scientists found strongly significant associations between excess risk of

- When 24-hour EC levels at a location are above 0.838 $\mu g/m^3$, then they are high enough to be associated with an excess risk of cardiovascular and respiratory hospitalizations on the day of exposure.[3]

Proximity to the Railyard:

The images below depict the location of representative sampling locations and their proximity to the Argentine Rail Yard.



As one might expect, there is a negative correlation between distance of the sample location from the boundary of the rail yard and the level of EC in the sample (that is, the greater the distance, the lower the EC level). The correlation coefficient is -0.31, which suggests a moderate, negative correlation between these two variables. A moderate correlation can be expected because there are other factors besides distance from the rail yard that will determine the EC level in a sample (e.g., wind speed and direction, level of diesel engine activity at the rail yard and weather conditions). So, for example, the sample collected on Sept 2-3 at 5421 Custer Ave, which is only 115 meters from the boundary of the rail yard, had a low EC level, likely

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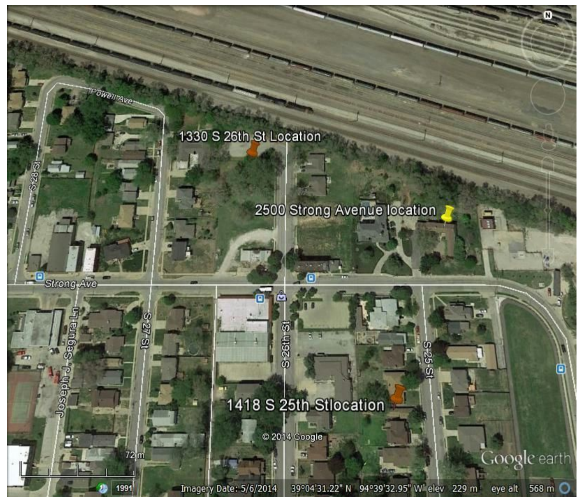
cardiovascular mortality two and three-days post exposure and the IQR for EC. The average level of EC in ambient air samples in the study was 0.966 $\mu g/m^3$. The IQR for EC was 0.795 $\mu g/m^3$. In this study, the 4th quartile level of EC was 1.36 (0.966 + [0.795/2]) $\mu g/m^3$. Ostro, et al. (2008) "The impact of components of fine particulate matter on cardiovascular mortality in susceptible subpopulations," *Occup. Environ. Med.*, 65;750-756.

[3] In 2009, scientists from Yale University, the Johns Hopkins University School of Public Health and the Keck School of Medicine, University of Southern California, published a study about the relationship between cardiovascular and respiratory hospitalizations, and the chemical composition of pollutant levels in ambient air in 106 different counties across the United States. These scientists examined the relationship between cardiovascular and respiratory hospitalizations and the IQR of EC levels. The scientists found strongly significant associations between excess risk of cardiovascular and respiratory hospitalizations and the IQR for EC. The average level of EC in ambient air samples in the study was 0.715 $\mu g/m^3$. The IQR for EC was 0.245 $\mu g/m^3$. In this study, the 4th quartile level of EC was 0.838 (0.715 + [0.245/2]) $\mu g/m^3$. Bell, et al. (2009) "Hospital Admissions and Chemical Composition of Fine Particle Air Pollution," *Am J Respir Crit Care Med*, 179:1115–1120.

because of rainy weather. If we exclude this sample from the statistical analysis, the negative correlation strengthens from -0.31 to -0.33.

Furthermore, seven of the eight of the ambient air samples with an EC level above 1 μg/m^3 were collected within 250 meters of the rail yard (the eighth sample above 1 μg/m^3 was collected at a distance of 325 meters of the rail yard. Of all samples collected within 250 meters of the rail yard, 23% (7 of 30 samples), had an EC level above 1 μg/m^3. By way of contrast, no sample collected more than 350 meters from the rail yard (0 of 13 samples, 0%) had an EC level above 1 μg/m^3.



On the totality of this evidence, it can be concluded that diesel emissions from the Argentine Rail Yard are negatively affecting air quality within 250 meters of the BNSF facility, placing residents at risk of acute health effects from exposure to diesel particulates. Measures to abate diesel emissions from the BNSF facility need to be considered.

Conclusions:

1. The BNSF locomotive maintenance shop and surrounding outdoor staging and locomotive testing area is the most dangerous source of emissions in the rail yard.

2. Residents within 300 meters of the rail yard, especially those near the maintenance shop, are at risk of exposure to dangerous levels of diesel exhaust pollution.

3. Exposure appears to be increased during periods of calm and very light winds regardless of wind direction, though this effect is difficult to distinguish from that of close proximity.

4. Community Air testing for EC/OC ultrafine hazardous particles in Argentine/Turner should continue, in order to monitor dangerous air pollution from the BNSF rail yard.

5. The Kansas Department of Health and Environment (KDHE) and U.S. Environmental Protection Agency (EPA) should monitor ultrafine particles on a regular basis and share the data with the public.

6. There is evidence that the closure of the old intermodal facility at the west end of the yard has resulted in reduced exposure to neighbors. However, the monitoring sample size in that area is too small to be conclusive. Additional monitoring is needed.

GCM and the Kansas Sierra Club also added to this analysis. Analyzing each of the 32 tests in relation to wind direction and speed explain certain data outcomes, such as:

- Some tests with low EC numbers were likely due to opposite wind direction from the rail yard.
- Some test data with higher than expected EC numbers where wind started from one direction and clocked around to the other direction may indicate a “bowl effect” due to the rail yard being at the bottom of a valley along the river.
- High EC numbers on the hill more than one mile away might be explained by the bowl effect swirling the soot around and around rather than dispersing it.

In addition, our data is consistent with other studies that demonstrate that current methods used by State and Federal Agencies for PM 2.5 do not accurately portray the ultrafine fraction created by diesel soot in areas polluted by by diesel emissions.

Sector Analysis of Argentine Rail Yard Diesel Emissions Exposure

by Craig Volland, QEP, Chair, Air Quality Committee, Kansas Sierra Club

Introduction. The BNSF Argentine Rail Yard is aligned roughly from west to east. Potential residential or institutional receptors of diesel emissions from the yard are located almost entire to the south of the yard. At a meeting last fall, BNSF said that the closure of the intermodal facility should greatly reduce any risk from diesel emissions from the yard. They indicated that the intermodal was phased out during the year and was closed by the time of our meeting on Nov. 13, 2014.

The intermodal facility had been operating at the western end of the yard. The purpose of this analysis is to assess BNSF's assertion by segmenting the monitoring sites along that west to east axis in order to, insofar as possible, isolate emission sources within the yard. The relevant value assessed here is elemental carbon (EC) that is widely accepted as a marker or surrogate for diesel emissions.

The Sectors. The sectors are bounded by north-south partitions. The sectors were, in part, selected to avoid confounding from vehicle emissions from I-635 and the 18th Street expressway. This buffer zone, wherein monitored values return to background levels, is generally estimated in the scientific literature to be within 200 to 300 meters of a heavily travelled road. The sectors are numbered from west to east with the "old intermodal" sector being No. 1 and the BNSF diesel locomotive maintenance shop, being No. 3.

Sector 1 includes all monitoring results west of 48th street and is intended to assess effects of the old intermodal. No sites were monitored within 800 meters of I-635.

Sector 2 includes all values between Goddard (29th St) and 42nd St., which is 280 meters east of I-635. This sector should measure impacts downwind of the neck of the yard and the wide, train-staging area.

Sector 3 includes all values between Goddard (29th St) and the 18th St. Expressway; however all monitoring sites in this sector are at least 650 meters west of the 18th St Expressway. This sector is intended to measure impacts downwind of the BNSF diesel locomotive maintenance shop.

Sector 4 includes all values east of the 18th St. Expressway. All these sites are more than 300 meters east of the 18th St expressway except for one, 100 meters from the road, whose only test result was obtained at a time when the site was not downwind of the yard.

See the link at the end of this text to access the database with segmented data, the sector maps and the full report. http://kansas.sierraclub.org/?p=4768

The Segmented Data. This analysis is based on the original data obtained from Global Community Monitor (GCM) assembled from the portable monitors deployed by Leticia DeCaigny and the Argentine Good Neighbor Committee from November 2, 2013 to January 19, 2015. In order to further assess the closure of the Intermodal section of the Argentine rail yard and to expand the data in the BNSF maintenance shop sector, the Kansas Chapter of the Sierra Club sponsored an additional five monitoring days from March 26, 2015 to May 11, 2015. The combined Excel file database was divided onto Sector Sheets 1 through 4 corresponding to monitoring site location. These were further divided into Sector Sheets 1a to 4a to house those values that were obtained when the site was generally downwind of the yard and/or the winds were mostly calm and less than 5 mph.

Because of the relatively low elevation of the yard and nearby residences in the Kansas River Valley there is a strong potential for temperature inversions where vertical convection is reduced and where emissions could move by diffusion in any direction. Wind speeds and directions were obtained for each 24 hour monitoring period from the *Weather Underground* website for the Downtown Kansas City Airport less than five miles away.[1]

Sheets 1a through 4a show those values deemed, from my analysis of all 24 hours of wind direction and speed, to have been generally downwind of the source or where there was a strong likelihood of a temperature inversion with many hours of calm, or wind speed less than 5 mph. The average EC for all sites and all times was 0.77 ug/M3.[2]

Results.
Average Downwind Monitored EC values in ug/M3

Sector	No.	No.	All down wind	300 M & less	300 M & less + low winds
1	Intermodal open	4	0.78	1.08	1.08
1	Intermodal closed	3	0.37	0.37	0.54
2		8	0.80	1.00	1.22
3	BNSF Shop	10	1.28	1.38	1.41
4		4	0.84	0.91	0.91

Discussion. The EC values obtained in Sector 1 after the intermodal facility was closed are consistent with a much reduced impact from diesel emissions in the west end of the yard. Although the April 2 & 3 EC values would likely have been attenuated somewhat by 9 hours of strong winds associated with a light rain event, the wind speed and direction during the other two post-closure measurements should have given a very good assessment of any emissions from the now closed intermodal operation.

However, the monitoring sites downwind of the diesel locomotive maintenance shop were significantly affected by that operation throughout the monitoring program. This assessment was clearly reinforced by the May 14 &15 supplemental measurement. The site for the May 11 & 12, 2015 measurement, to the west-southwest of the maintenance shop, was deemed to have been upwind of the source because the wind blew generally from the west for all but three hours. Just prior to this test, we had expected to have a more extended period of wind from the northeast & east which did not materialize.

All the sector 4 downwind values appear to also be influenced by the BNSF shop. The lower averages reflects the fact that all but one were obtained well beyond 300 meters from the east end of the yard, and further yet from the shop.

Winds were calm, or less than 5 mph, during at least 8 hours, in 17 of the 29 downwind, 24- hour measurements. So there seems to be a "bowl effect." However, there is insufficient data to adequately distinguish between that effect and the effect of a site being within 300 meters of the yard.

Conclusions:

1. Diesel emission exposure was substantially elevated at nearby residential receptor sites both to the north and south of the BNSF diesel locomotive maintenance shop during GCM's monitoring program at the Argentine rail yard. The shop is clearly the most important source of emissions in the yard, and its operation is ongoing;

2. Residents within 300 meters of the yard east of the old intermodal are at risk of greater exposure, and especially near the maintenance shop;

3. Exposure appears to be increased during periods of calm and very light winds regardless of wind direction, though this effect is difficult to distinguish from that of close proximity.

4. The closure of the intermodal operation in 2014 appears to have resulted in significantly reduced exposure to diesel emissions south of that area at the west end of the rail yard.

The data supporting this analysis and maps of the monitoring sites in the four study sectors may be accessed at this link: http://kansas.sierraclub.org/?p=4768

Medical Studies on Diesel Pollution

Vehicle exhaust, primarily diesel exhaust, is the predominant source of Elemental Carbon (EC) in ambient air. The following two studies were used to determine the relative health risks of the EC/OC concentrations:

1. In 2008, scientists from the California Office of Environmental Health Hazard Assessment (OEHHA) published a study about the relationship between cardiovascular mortality and the chemical composition of pollutant levels in ambient air in California. These scientists examined the relationship between cardiovascular mortality and the interquartile range (IQR = the difference between the third and first quartiles) of EC levels. The scientists found strongly significant associations between excess risk of cardiovascular mortality two and three-days post exposure and the IQR for EC. The average level of EC in ambient air samples in the study was 0.966 µg/m3. The IQR for EC was 0.795 µg/m3. In this study, the 4th quartile level of EC was 1.36 (0.966 + [0.795/2]) µg/m3. Ostro, et al. (2008) "The impact of components of fine particulate matter on cardiovascular mortality in susceptible subpopulations," Occup. Environ. Med., 65;750-756.

2. In 2009, scientists from Yale University, the Johns Hopkins University School of Public Health and the Keck School of Medicine, University of Southern California, published a study about the relationship between cardiovascular and respiratory hospitalizations, and the chemical composition of pollutant levels in ambient air in 106 different counties across the United States. These scientists examined the relationship between cardiovascular and respiratory hospitalizations and the IQR of EC levels. The scientists found strongly significant associations between excess risk of cardiovascular and respiratory hospitalizations and the IQR for EC. The average level of EC in ambient air samples in the study was 0.715 µg/m3. The IQR for EC was 0.245 µg/m3. In this study, the 4th quartile level of EC was 0.838 (0.715 + [0.245/2]) µg/m3. Bell, et al. (2009) "Hospital Admissions and Chemical Composition of Fine Particle Air Pollution," Am J Respir Crit Care Med, 179:1115–1120.

Organizational Sponsorship and Support

This report describes the outcome of air pollution monitoring initiated by the Diesel Health Project, a Kansas not-for-profit organization sponsored by the Sustainability Action Network, a 501(c)(3) nonprofit.

The Diesel Health Project was formed in 2013 by Richard Mabion, long-time Kansas City Kansas resident and community activist, and Eric Kirkendall of Lawrence, Kansas with the mission of

> ...protecting the health of the community by identifying and documenting environmental and health problems caused by freight transportation in the Kansas City region, particularly diesel exhaust and other pollutants emitted by freight transportation, warehousing, and related activities, and taking action to ensure that the problems are mitigated as early and effectively as possible.

The international organization Global Community Monitor (GCM), provided the monitoring equipment and training, laboratory, consulting, and much other assistance. The Kansas Sierra Club provided invaluable technical assistance and consulting.

Leticia DeCaigny, born and raised in Argentine, current Turner resident, and Diesel Health Project community organizer, worked with her neighbors to form the Argentine/Turner Good Neighbor Committee, and led the monitoring. The Argentine/Turner Good Neighbor Committee provided leadership, advice, and governance for this project.

Photo source: Kansas City Star, "Diesel fumes near Kansas City, Kan., rail yard pose health threat, report says"

This project was funded by the Kresge Foundation, through Global Community Monitor and the Diesel Health Project, with additional financial support from the Kansas Chapter of the Sierra Club.

The Diesel Health Project is a member of the national Moving Forward Network (MFN) . The MFN and its members provided invaluable inspiration, funding, and consulting support.

Many others contributed to this project and made it possible. The U.S. Environmental Protection Agency Region 7 and the Children's Mercy Hospital Center for Environmental Health provided advice and consultation. The National Resources Defense Council provide GIS maps, demographic, and other data. Faculty and students with the University of Kansas Environmental Studies Program provided GIS mapping and other support. The provide advice and consultation.

Requests to the BNSF by the Argentine/Turner Good Neighbor Committee

The Good Neighbor Committee has studied and discussed the risks of diesel carbon emissions from the BNSF Rail Yards to the Argentine Community. We will presenta report with the results of our tests to the community at Argentine Community Center and invit BNSF representatives to attend. We acknowledge and will mention that the shutting down of the intermodal facility in Argentine yards and its move to Gardner has improved the air quality in some areas near the rail yard and that the overhaul of three switch engines, retrofitting them to Tier 2 emissions level, is a step in the right direction.

We hope we can announce that BNSF takes our concerns very seriously and acknowledges that diesel exhaust emissions from diesel engines present risks to the residents in areas surrounding the rail yard. We would like to be able to tell the community that BNSF has agreed to take the following actions we have requested:

1. To enclose in a building the area where locomotives being overhauled at the maintenance facility are tested and to place air handlers and scrubbers on the roof of that building to treat the exhaust thus limiting contamination of the air both to employees and the neighborhood.

2. To develop a plan to move toward zero emissions beyond their fenceline as soon as possible, and to have no locomotives with greater than Tier 3 emissions within three years. To achieve this BNSF will need to put in place an accelerated schedule of upgrades and retrofitting of switch engines. (We assume BNSF is using low sulfur fuel that will allow the upgrade.)

3. To install a real-time fence-line monitoring system to check black carbon, elemental carbon or other diesel markers.

4. To keep the Good Neighbor Committee informed on a regular basis of progress in lowering diesel particle emissions.