Iowa Annual Data Review 2013 – Manganese

Ambient Air Monitoring Group
Iowa Department of Natural Resources

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Summary

Iowa Department of Natural Resources (DNR) Manganese Monitoring

The DNR operates a manganese monitoring site near Griffin Pipe Products Company in Council Bluffs (Appendix A. Council Bluffs Monitoring Locations). Griffin Pipe utilizes manganese in its pipe manufacturing process, and these emissions are large enough that Griffin Pipe is required to provide estimates of its air emissions of manganese to EPA's toxic release inventory (TRI). Utilizing TRI emissions estimates from industries across the nation, USA Today used an EPA risk assessment tool to establish a list of schools across the nation with elevated risk due to air toxic emissions. This list of schools included schools near Griffin Pipe, and the excess risk at these schools was attributed to manganese emissions from Griffin Pipe. In the aftermath of the USA Today report, EPA utilized a long-term "non-cancer" reference concentration of 50 ng/m^3 to evaluate the results of manganese sampling it conducted.[1] EPA indicated that monitoring sites that experienced levels above this threshold would be the focus of ongoing monitoring and the development of a mitigation strategy.[2] DNR began manganese monitoring near Griffin Pipe in 2011. The site average during 2011 was 104 ±53 ng/m^3.[3] To reduce the uncertainty in the site average, the sampling frequency in 2012 was increased to one sample every third day, and an annual average at the Griffin Pipe monitoring site of 95 ±16 ng/m^3 was produced.*4* Monitoring in 2013 followed the same sampling frequency and yielded an average concentration of 79 ±14 ng/m^3 which is well above the reference concentration established by EPA.

DNR recorded lead NAAQS violations at the Griffin Pipe monitoring site in 2010 and 2012, and an area near Griffin Pipe has been designated by EPA to be in non-attainment with the lead NAAQS.[4] DNR is developing a State implementation Plan (SIP) in order to mitigate these violations. Griffin Pipe and Alter Metal Recycling have performed lead analysis on silt samples gathered on their property, and dispersion modeling conducted by the DNR suggests that the dust raised by truck traffic at these facilities can be a significant contributor to lead NAAQS violations. Among the control measures anticipated in the SIP are requirements to reduce these emissions by sweeping roads. Road sweeping requirements, along with the other measures to be specified in the SIP, are expected to result in ambient lead levels below the NAAQS at the monitoring site and throughout the non-attainment area.

Silt sampling performed by Griffin Pipe also suggested the potential for significant contributions to ambient manganese levels from entrainment of fugitive dust by truck traffic. DNR expects that SIP measures to reduce road dust at the facilities are also likely to result in significant decreases in ambient manganese levels.

In March 2014, Griffin Pipe indicated that until economic conditions improve, it would discontinue pipe production in Council Bluffs and employ only a skeleton crew at the facility.[5] Griffin Pipe has continued to work with the DNR to establish federally enforceable control measures to be included in the SIP, in anticipation of an eventual return to production.

Additional Information

Additional details on the manganese sampling conducted in Iowa during 2013 are indicated below.

Definitions

- *Data Capture*. The data capture rate is defined as the ratio of the number of samples taken (including scheduled and valid substitute samples) divided by the number of scheduled samples in each calendar quarter. EPA data analysis guidelines usually require 75% data completeness across each sampling quarter.
- *Precision Data*. Precision data are reported for the total number of collocated pairs of samples collected. Precision statistics shown in this report have been calculated according to current methodology outlined in *40 CFR Part 58, Appendix A* using the methodology applicable to collocated filter samplers. (See Appendix B. Precision Calculations)

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[1] USA Today: "The Smokestack Effect; Toxic Air and America's Schools"

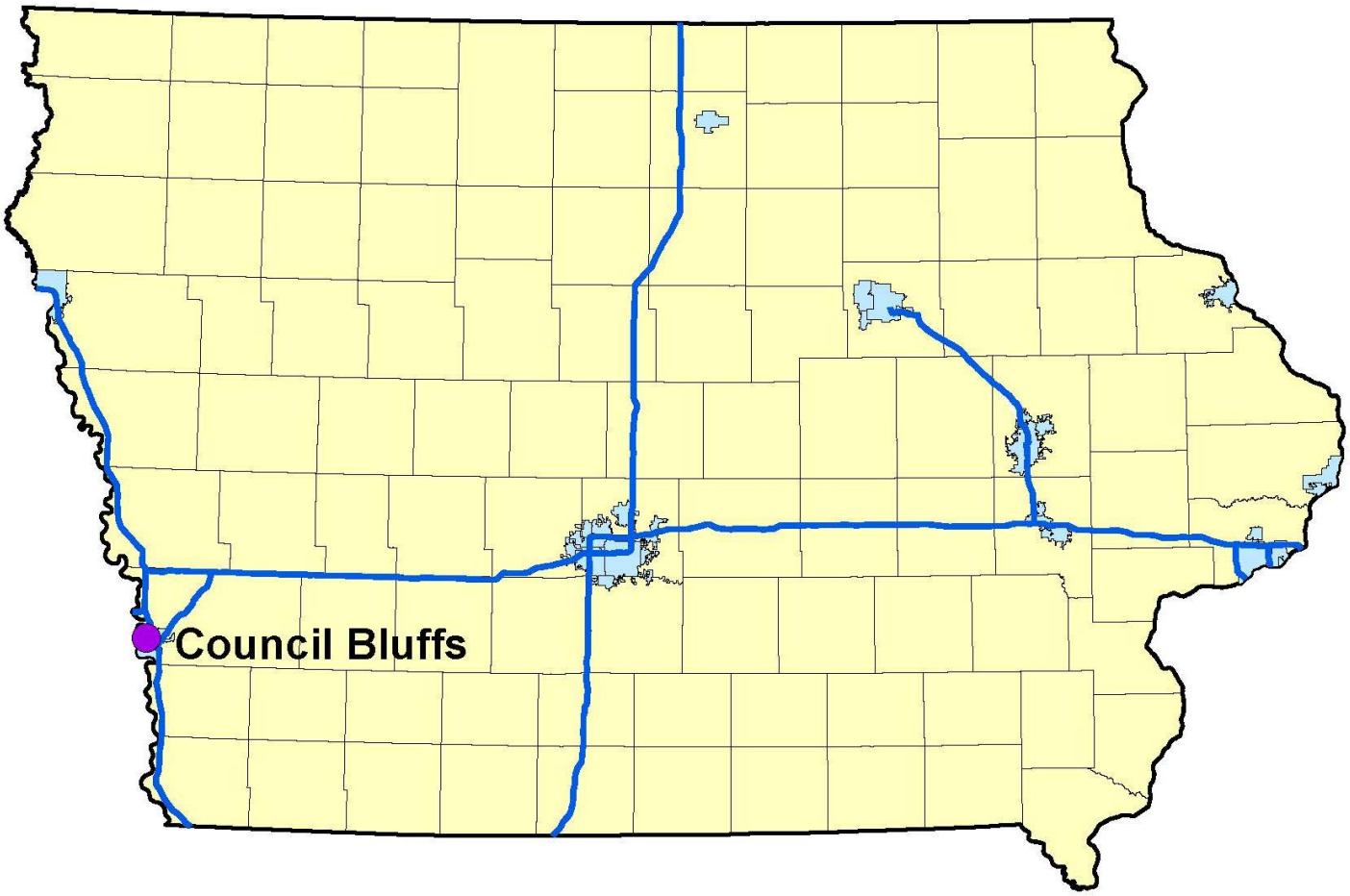
[2] Quality Assurance Project Plan For the EPA School Air Toxics Monitoring Program

[3] Iowa DNR 2011 Manganese Report 4 Iowa DNR 2012 Manganese Report

[4] EPA Lead Nonattainment Areas

[5] KETV: Griffin Pipe goes to skeleton crew

Manganese Monitoring Network – 2013



Site ID	Site Label	City	Address	County
191550011	Council Bluffs, Griffin Pipe	Council Bluffs	8th Avenue and 27th	Pottawattamie

Concentration Summary (ng/m3)

Site / Pollutant	Council Bluffs, Griffin Pipe
Manganese	79 (±14)

The value indicated is the average concentration measured in 2013.
The value in parentheses represents the variance in concentration as calculated from the 95% Confidence Interval for the mean.

2011-2013 Manganese Concentration Summary Chart

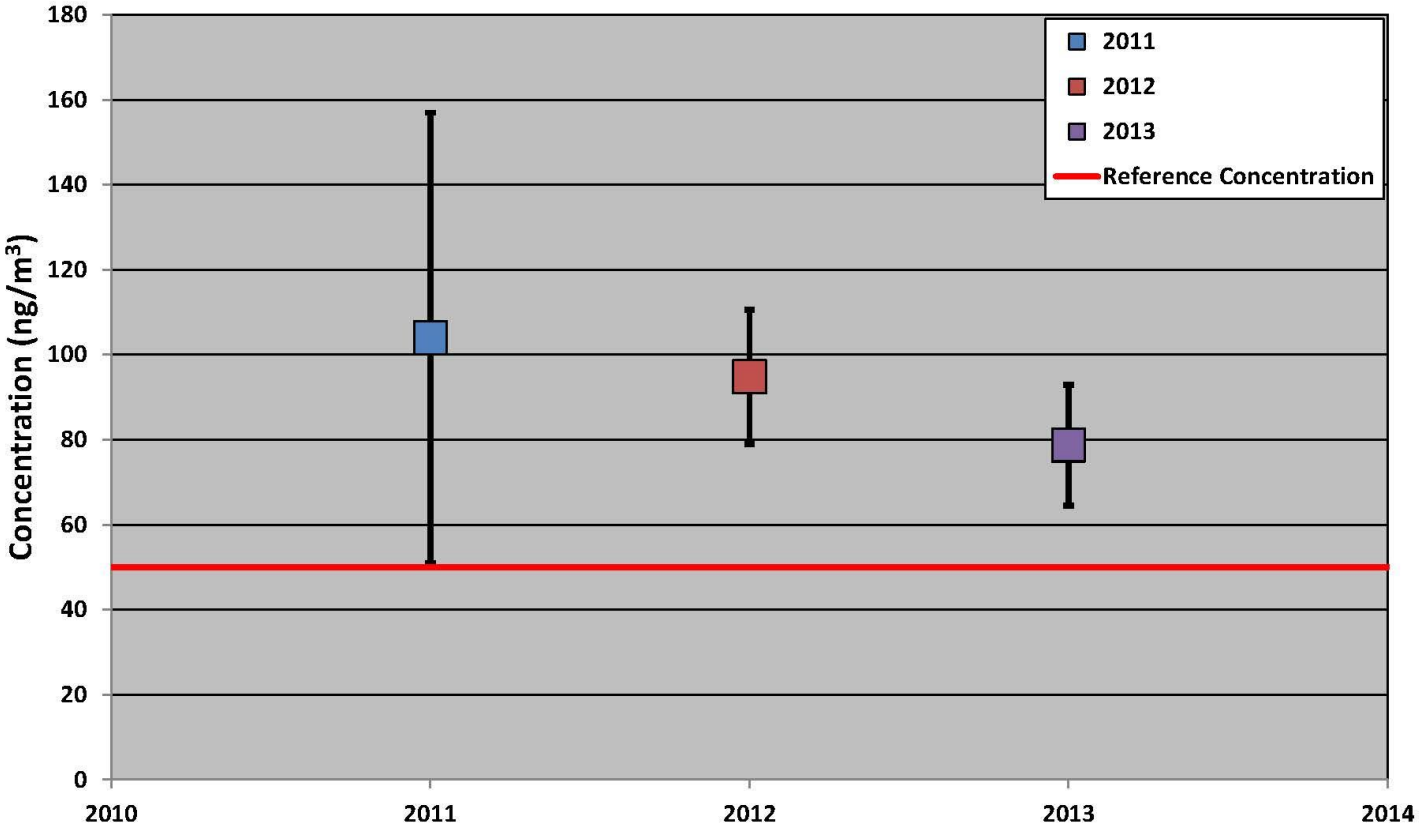


Chart depicting the average concentration of airborne manganese for each year and the uncertainty. Longer error bars mean greater uncertainty. The error bars are much shorter for 2012 and 2013 which implies less uncertainty in the annual average.

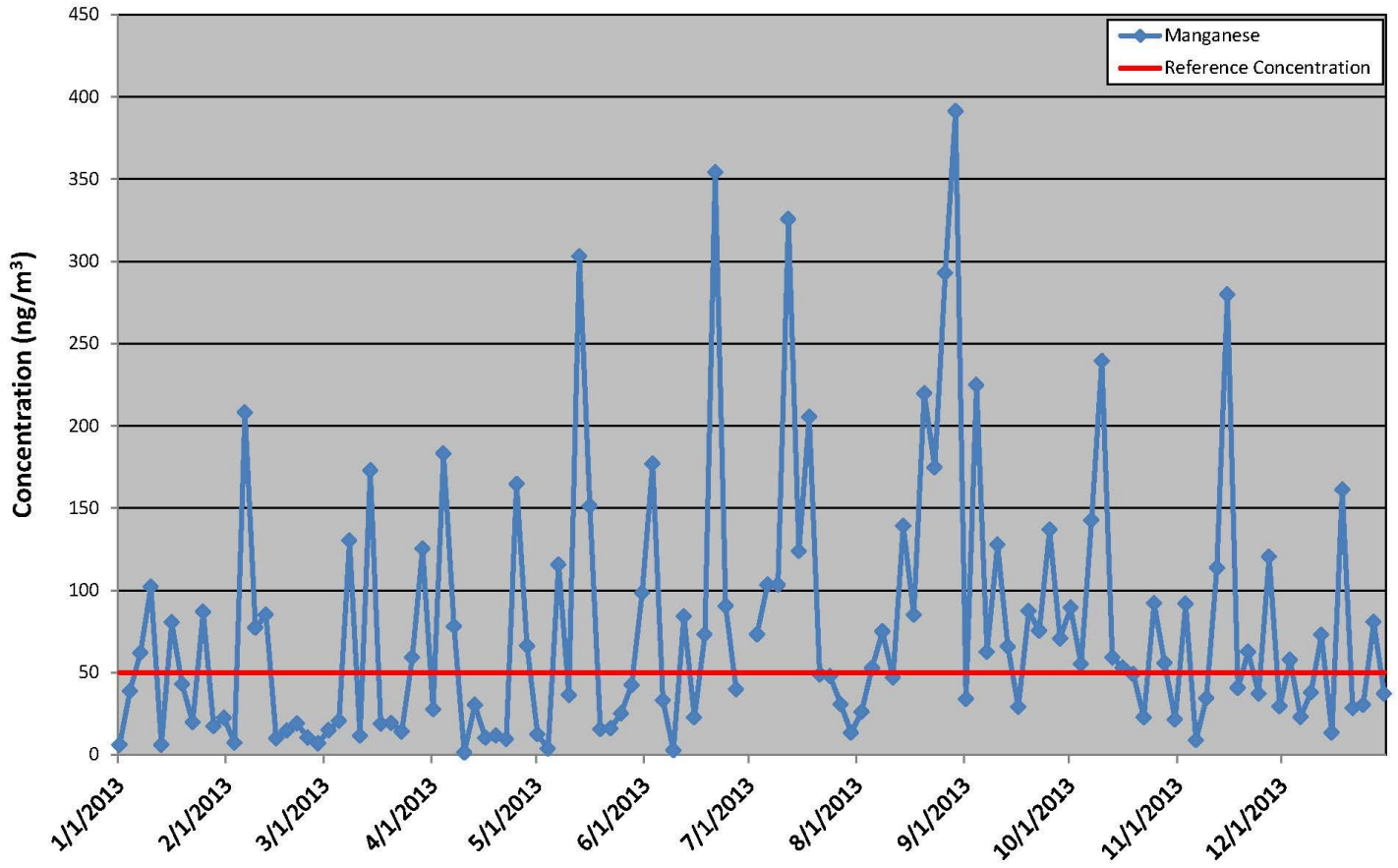
2013 Percent Manganese Data Capture

Council Bluffs, Griffin Pipe
99%

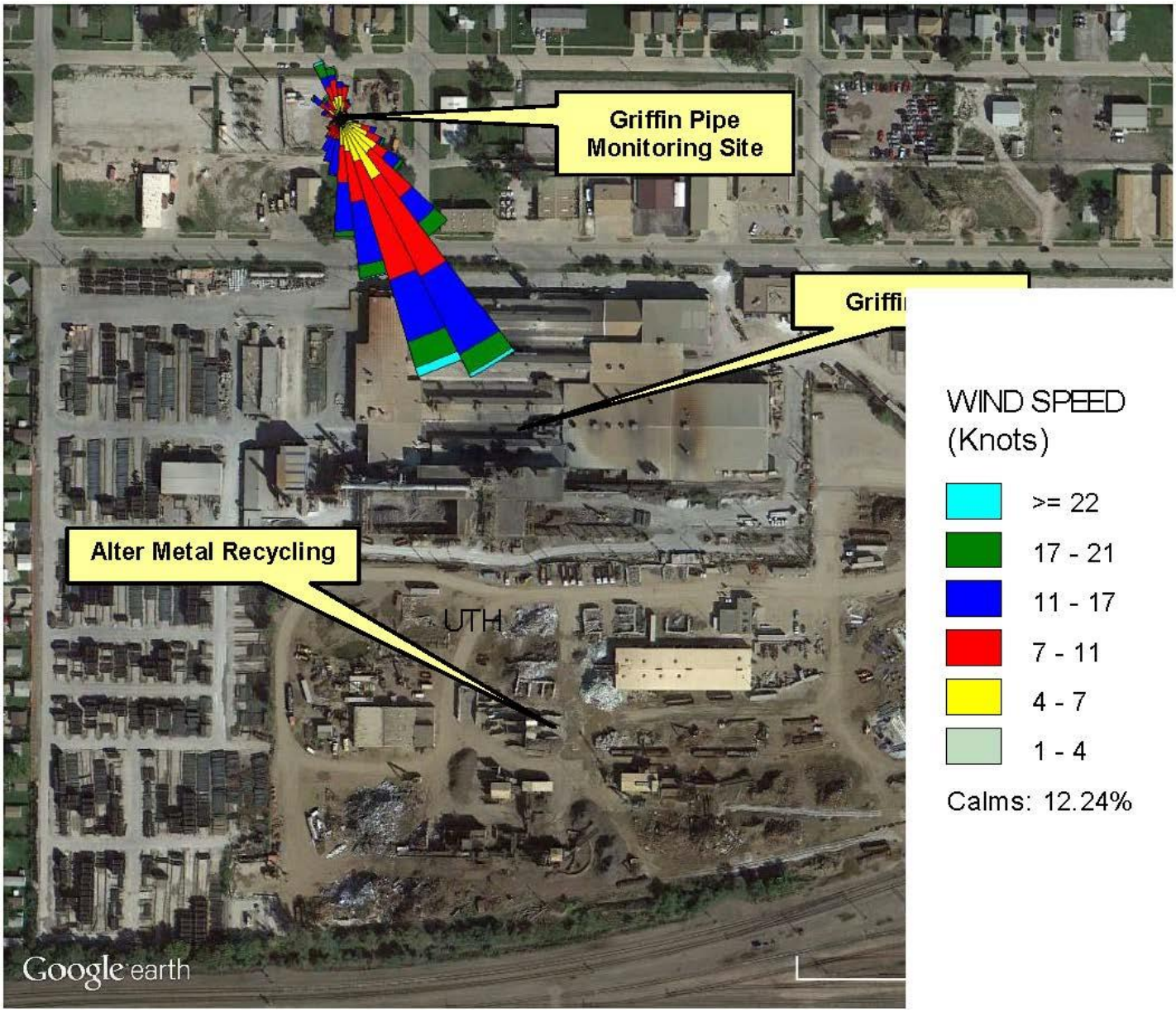
2013 Annual Manganese Precision Statistics

Number of Pairs	Upper 90% Confidence Limit
58	22%

Manganese Levels Recorded in 2013 at the Griffin Pipe Monitoring Site in Council Bluffs

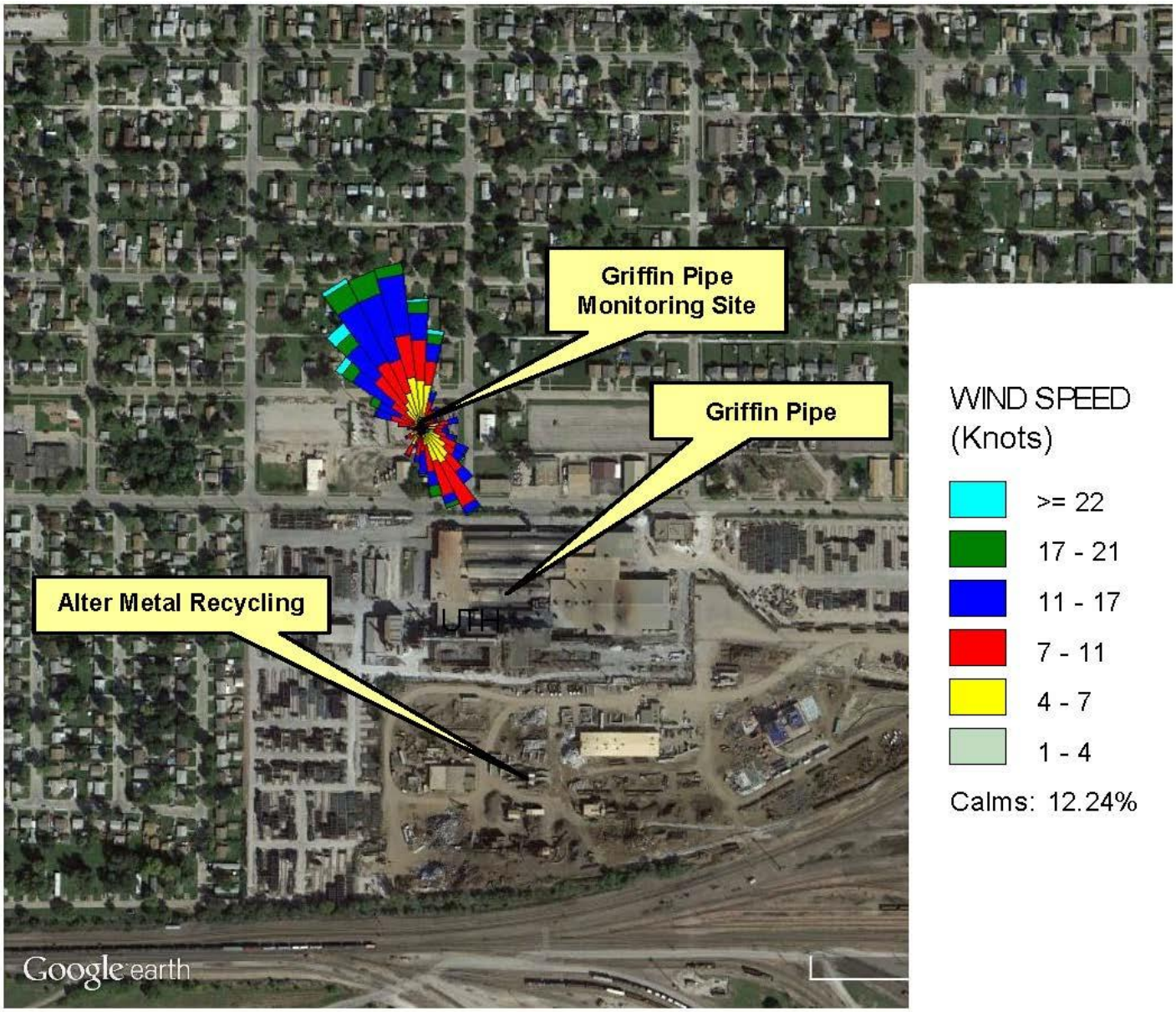


Wind Rose for Days with High Manganese Concentrations



Wind rose depicting primary wind directions and speeds on days where average manganese concentrations were at or above the level of the EPA reference concentration of 50 ng/m3. The rose shows winds to be primarily southeasterly on days when these high levels occurred. A comparison of these winds, the yearly wind rose and a summary of how the roses are calculated can be found in Appendix C. Wind Rose Explanation and Comparison of Wind Data.

Wind Rose for Days with Low Manganese Concentrations



Wind rose depicting primary wind directions and speeds on days where manganese concentrations remained below the level of the EPA reference concentration of 50 ng/m3. The rose shows winds to be primarily north and northwesterly on days when average concentrations remain below 50 ng/ m3. A comparison of these winds, the yearly wind rose and a summary of how the roses are calculated can be found in Appendix C. Wind Rose Explanation and Comparison of Wind Data.

Manganese Raw Data 2013–Council Bluffs

Date	Mn (ng/m^3)	Date	Mn (ng/m^3)	Date	Mn (ng/m^3)
1/1/2013	5.96	5/4/2013	3.8	9/4/2013	224.88
1/4/2013	38.6	5/7/2013	115.55	9/7/2013	62.41
1/7/2013	61.87	5/10/2013	36.23	9/10/2013	127.78
1/10/2013	102.09	5/13/2013	303.06	9/13/2013	65.78
1/13/2013	5.92	5/16/2013	151.24	9/16/2013	29.02
1/16/2013	80.5	5/19/2013	15.52	9/19/2013	87.37
1/19/2013	42.77	5/22/2013	15.96	9/22/2013	75.35
1/22/2013	19.73	5/25/2013	25.2	9/25/2013	136.86
1/25/2013	86.76	5/28/2013	42.42	9/28/2013	70.56
1/28/2013	17.21	5/31/2013	98.27	10/1/2013	89.43
1/31/2013	22.49	6/3/2013	176.89	10/4/2013	54.97
2/3/2013	7.19	6/6/2013	33.07	10/7/2013	142.58
2/6/2013	208.03	6/9/2013	2.7	10/10/2013	239.41
2/9/2013	77.1	6/12/2013	84.17	10/13/2013	59.06
2/12/2013	85.11	6/15/2013	22.64	10/16/2013	53
2/15/2013	9.9	6/18/2013	73.1	10/19/2013	48.87
2/18/2013	14.61	6/21/2013	354.11	10/22/2013	22.6
2/21/2013	18.88	6/24/2013	90.34	10/25/2013	92.12
2/24/2013	10.39	6/27/2013	39.7	10/28/2013	55.65
2/27/2013	6.86	6/30/2013		10/31/2013	21.34
3/2/2013	14.88	7/3/2013	73.22	11/3/2013	91.66
3/5/2013	20.52	7/6/2013	103.27	11/6/2013	8.81
3/8/2013	130.21	7/9/2013	103.31	11/9/2013	34.27
3/11/2013	11.46	7/12/2013	325.65	11/12/2013	113.63
3/14/2013	172.86	7/15/2013	123.83	11/15/2013	279.86
3/17/2013	18.82	7/18/2013	205.35	11/18/2013	40.61
3/20/2013	19.23	7/21/2013	48.8	11/21/2013	62.54
3/23/2013	14.06	7/24/2013	47.67	11/24/2013	36.98
3/26/2013	59	7/27/2013	30.68	11/27/2013	120.39
3/29/2013	125.22	7/30/2013	13.29	11/30/2013	29.42
4/1/2013	27.52	8/2/2013	26	12/3/2013	57.66
4/4/2013	183.06	8/5/2013	52.71	12/6/2013	22.98
4/7/2013	78.1	8/8/2013	74.91	12/9/2013	37.73
4/10/2013	1.25	8/11/2013	46.92	12/12/2013	72.82
4/13/2013	30.3	8/14/2013	139.18	12/15/2013	13.26
4/16/2013	10.32	8/17/2013	85.08	12/18/2013	161.14
4/19/2013	11.57	8/20/2013	219.6	12/21/2013	28.34
4/22/2013	9.45	8/23/2013	174.71	12/24/2013	30.21
4/25/2013	164.58	8/26/2013	292.74	12/27/2013	80.68
4/28/2013	66.14	8/29/2013	391.32	12/30/2013	37.08
5/1/2013	12.32	9/1/2013	33.79		

Appendix A. Council Bluffs Monitoring Locations

Manganese data in this report was obtained from the Griffin Pipe Monitoring site located approximately 200 yards northwest of the main stack of the Griffin Pipe Products Company in Council Bluffs, Iowa. Meteorological data was collected at the KOMA Automated Weather Observing system (AWOS) site at the Eppley Airfield in Omaha, Nebraska. KOMA is approximately 3 miles NNW of the Griffin Pipe monitoring site.

Appendix B. Precision Calculations

Let c_i^1 and c_i^2 represent two concentrations from a particular monitoring location taken on the same day. If both are greater than the MDL, then they may be used to estimate the precision of the data at the sampling location as follows:

First compute the average:

$$\overline{c_i} = \frac{c_i^1 + c_i^2}{2}$$

And the mean difference:

$$d_i = \frac{c_i^1 - c_i^2}{c_i} \times 100$$

Finally, compute the upper confidence limit in the usual way (See: 4.2.1 of 40 CFR Part 58, Appendix A):

$$Upper\ 90\%\ Confidence\ Limit\ of\ CV = \frac{s}{\sqrt{2}} \times \sqrt{\frac{n-1}{X^{-1}(0.90, n-1)}}$$

Where *s* is the sample standard deviation of the mean difference (d_i), and X^{-1} represents the inverse of the chi-squared distribution.

Appendix C. Wind Rose Explanation and Comparison of Wind Data

The wind rose is a graphical representation of the frequency of a wind from a given direction at a given location. The longer the petal, the more frequently that location experienced winds from that direction.

The colors represent the percentage of time the winds are at a given speed from a direction. Calm winds are not shown on the wind rose. They are denoted at the bottom of the color legend to the right of a wind rose plot.

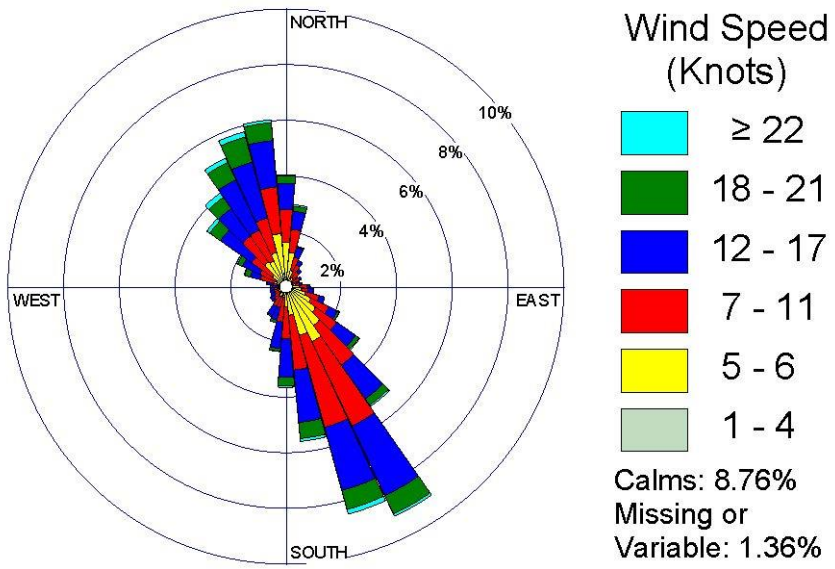


Figure 1: Yearly wind rose from the Omaha Eppley Airfield (KOMA) Automated Surface observing System (ASOS). Prevalent wind directions for the entire year range from the north and northwesterly along with south and southeasterly.

Wind data selected for this report consisted of all 2013 quality-controlled observations from the nearest Automated Surface Observing System (ASOS) site. The observations are stored on the National Climatic Data Center (NCDC) servers for download. Listed wind speeds are given in knots.

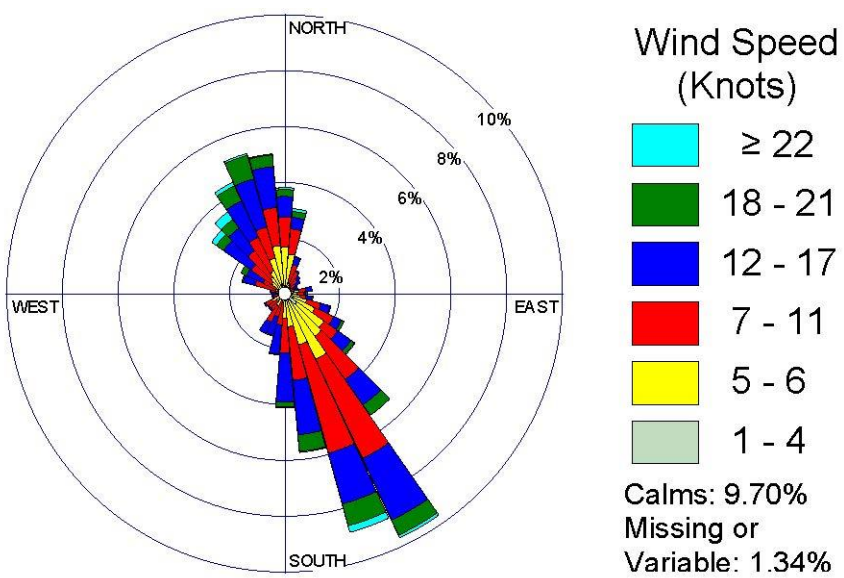


Figure 2: Wind rose from KOMA ASOS on days when manganese sampling occurred. The outputted rose is very similar to the rose representing an entire year's worth of wind data. This suggests that winds on sampling days are representative

of and comparable to the whole year's wind data.

Data for the year 2013 was fed into a program that sorted through the dataset and selected the wind reading that was associated with the standard hourly observation time. Special observations were ignored because they may not be representative of the given time period. If winds were variable in direction they were also excluded from the data set.

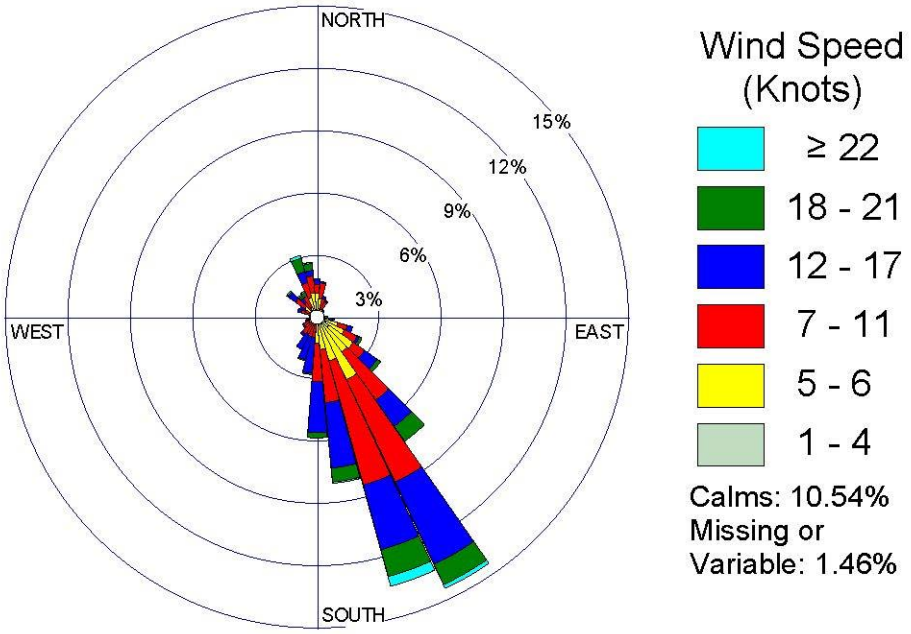


Figure 3: Wind rose from KOMA ASOS on days with high concentrations of manganese. Winds out of the south and southeast are dominant in this diagram which suggests the source is southeast of the monitor.

Figure 1 represents the yearly wind rose from the ASOS site at Omaha Eppley Airfield (KOMA). The wind rose shows that the majority of the winds are from the north, northwest, south and southeast. Most of the wind speeds in a given year are less than twelve (12) knots.

Figure 2 represents the wind rose on the 121 days in which manganese sampling occurred. Data for the wind direction, speed distribution, number of calm winds and missing data are similar to the entire set for 2013. This suggests that the wind data on days where manganese sampling occurred is likely to be representative of the winds throughout 2013.

Figure 3 represents the wind rose on the 63 sampling days in which the level of the EPA reference concentration for manganese was exceeded. Over 50% of all recorded non- calm, non-variable and non-missing winds had directions out of the south and southeast on days where concentrations greater than 50 ng/m3 were recorded. This suggests that the source of the airborne manganese lies to the south and southeast of the monitor.

Figure 4 shows a wind rose on the 58 sampling days in which manganese concentrations were 50 ng/m3 or less. In this diagram winds are more prevalent out of the north and northwest.

It is important to note that Figures 2 through 4 represent all hourly winds recorded on manganese sampling days. If the wind switches directions during the course of the day with an elevated manganese concentration, it is not possible to determine if the elevated levels originate from sources in one or both directions.

The majority of the petals representative of southerly and southeasterly winds were recorded on days with manganese concentrations above 50 ng/m3. The majority of petals from the north and northwest where recorded on days with manganese concentrations of 50 ng/m3 or less. These observations suggest that sources to the north, west and east are

not responsible for elevated manganese concentrations.

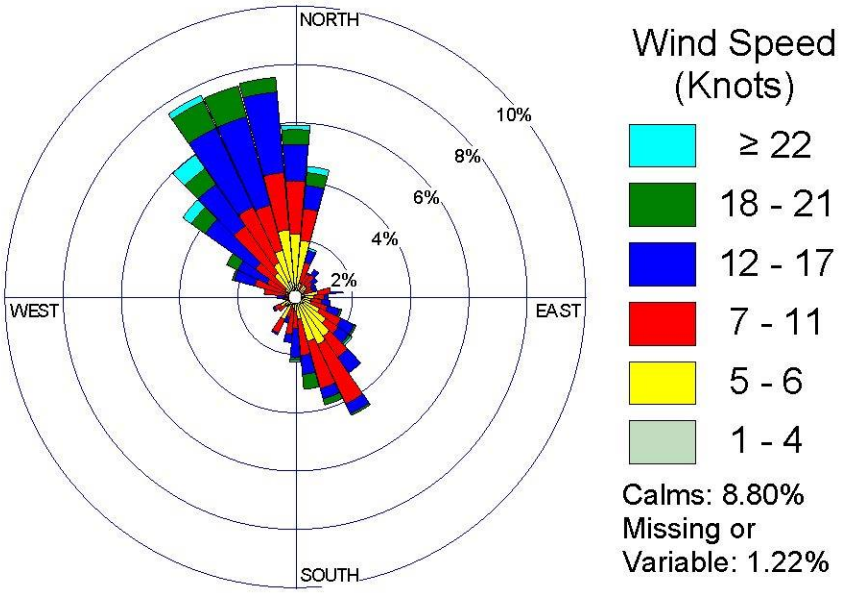


Figure 4: Wind rose showing wind directions and speeds on days when observed manganese concentrations were 50 ng/m^3 or less.