Quarterly Results for the 2017-2018 Air Monitoring Program: January 16, 2018 - April 15, 2018

Prepared for

PCC Structurals, Inc.

June 2018

CH2M HILL Engineers, Inc.
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Contents

Acronyms and Abbreviations

AB	ambient field blank
ARA	ARA Instruments
As	arsenic
ASTM	ASTM International
Be	beryllium
CH2M	CH2M HILL Engineers, Inc.
Cd	cadmium
Co	cobalt
Cr	chromium
Cr^{6+}	hexavalent chromium
EPA	U.S. Environmental Protection Agency
ICP/MS	inductively coupled plasma mass spectrometry
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MS/MSD	matrix spike/matrix spike duplicate
NFG	National Functional Guidelines
Mn	manganese
Ni	nickel
NIST	National Institute of Standards and Technology
Pb	lead
QC	quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
Se	selenium

SECTION 1

Introduction

CH2M HILL Engineers, Inc. (CH2M) is performing air monitoring for PCC Structurals, Inc., at one location in Portland, Oregon. Samples are being collected with two ARA Instruments (ARA) N-FRM sampling and monitoring devices every 3 days according to the U.S. Environmental Protection Agency (EPA) sampling schedule. One ARA sampler is equipped to collect filter samples for metals, the other ARA sampler is configured with a sampling cane and filter cartridge to collect hexavalent chromium (Cr6+). Samples are collected for a duration of 24 hours. Filter samples are analyzed for the following metals by ALS Laboratories: arsenic (As), beryllium (Be), cadmium(Cd), total chromium (Cr), cobalt (Co), lead (Pb), manganese (Mn), nickel (Ni), and selenium (Se). Filter cartridge samples are analyzed for Cr6+ by CHESTER LabNet.

This report summarizes the quarterly results and quality assurance activities performed between January 16, 2018, and April 15, 2018. The monitoring location is shown on Figure 1.

SECTION 2

Data

CH2M conducted 30 sampling events during this reporting period. However, one sample for metals was misplaced and not sent to the analytical laboratory and two samples for Cr6+ were not collected due to sampler error. Data completeness goals for metals and Cr6+ exceeded the project goal of 80 percent (see Table 1). Complete results are presented in Appendix A.

Table 1. 24-hour Average Data Completeness for January 16, 2018, through April 15, 2018
Quarterly Results for the 2017-2018 Air Monitoring Program: January 16, 2018 - April 15, 2018

Period	Valid Readings (Days)	Possible Readings (Days)	Data Completeness (Percent)
M1- Metals	29	30	97
M2-Cr6+	28	30	93
Total	57	60	95

SECTION 3

Field Data Quality

3.1 Field Quality Assurance and Quality Control Activities

3.1.1 Monthly Flow Verifications

The ARA N-FRM instrument's temperature, pressure, and flow rate are verified against a National Institute of Standards and Technology (NIST) traceable flowmeter at least once per month. None of the results exceeded the measurement quality objective of +/- 6 percent. Results from monthly flow verifications are presented in Appendix B.

3.1.2 Quarterly Audits

At least once per quarter, the ARA N-FRM instrument's pressure and flow rate are verified against a secondary NIST traceable flowmeter. None of the results exceeded the measurement quality objective of +/- 6 percent. Results from the quarterly audit are presented in Appendix C.

3.2 Corrective Actions March-April 2018

Issue: The Cr6+ sampler instrument M-2 did not successfully complete a sample run on February 28, 2018, and April 4, 2018.

Corrective Action: CH2M sent the sampler back to the manufacturer for a battery of tests. The sampler passed all tests and all calibrations were within specifications. The unit was returned to the site. The equipment manufacturer suspects that dense fog or rain could possibly be causing a blockage of the chemically coated filter. CH2M will continue to investigate this issue.

Issue: A filter for metals analysis was misplaced and not sent to the analytical laboratory.

Corrective Action: A designated cooler has been placed in an area in the Portland office for all metals samples.

SECTION 4

Analytical Data Quality

This quarterly report covers 57 air monitoring samples. These samples were reported under six sample delivery groups (SDGs) by the laboratories in this reporting period. Two methods were used to analyze the environmental samples and are listed in Table 2. The analyses were performed by ALS Laboratories in Salt Lake City, Utah, and CHESTER LabNet in Tigard, Oregon. Samples were collected and delivered by commercial carrier to the laboratories.

Table 2. Analytical Parameters by Laboratory
Quarterly Results for the 2017-2018 Air Monitoring Program: January 16, 2018 - April 15, 2018

Parameter	Method	Laboratory
Chromium, Hexavalent	ASTM D7614-12	CHESTER LabNet
Metals	ICP-MS	ALS Laboratories

Notes:

ASTM = ASTM International

ICP-MS = inductively coupled plasma mass spectrometry

4.1 Methodology

The SDGs were assessed by reviewing the following: (1) chain-of-custody documentation, including sample cooler temperatures and appropriate sample preservation; (2) holding-time compliance; (3) required quality control (QC) samples at the specified frequencies; (4) detection limits; (5) analytical blanks and field blanks; (6) laboratory control sample/laboratory control sample duplicate (LCS/LCSD) precision and recoveries; (7) matrix spike/matrix spike duplicate (MS/MSD) precision and recoveries; (8) laboratory precision; and (9) additional method-required QC samples.

Data flags were assigned according to the National Functional Guidelines (NFG) (EPA, 2016a and 2016b). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will only be one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags utilized are those listed in the NFG. The data flags are defined as follows:

- J1 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample due to concentrations between the detection limit and quantitation limit.
- J2 = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample due to flags applied during the validation process.
- R = The sample result was rejected because of deficiencies in the ability to analyze the sample and meet the QC criteria. The presence or absence of the analyte could not be verified. Data flagged “R” should not be used in a decision-making process.
- U = The analyte was analyzed for but was not detected above the reported sample quantitation limit or a detection in the samples was changed to a nondetected result and flagged “U” due to blank contamination.

- UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

4.2 Findings

The overall summaries of the data validation are contained in the following sections. Qualified data are listed in Appendix D.

4.2.1 Holding Time/Preservation

All method-recommended holding time and preservation criteria were met.

4.2.2 Laboratory QC Samples

4.2.2.1 Method Blanks

A method blank is a clean matrix and is carried through the same analytical procedures as the environmental samples. Method blank samples are used to monitor each preparation or analytical batch for contamination throughout the entire analytical process. Method blank samples were analyzed at the required frequency and were generally free of contamination, with the following exception:

- Chromium was detected above the reporting limit (RL) in one or more laboratory method blanks. Fourteen associated detected sample results were less than or equal to five times the blank concentrations and were qualified as not detected and flagged “U.”

4.2.2.2 Field Blanks

A field, or ambient, blank is a sample collected to evaluate the ambient air conditions at the site. It uses the same sample collection techniques as the environmental samples. Field blank samples were analyzed at the required frequency and were generally free of contamination, with the following exceptions:

- Manganese was detected below the RL in one ambient field blank (AB). One associated detected sample result was less than or equal to five times the blank concentration and was qualified as not detected and flagged “U.”
- Chromium was detected above the RL in one or more ABs. Twelve associated detected sample results were less than or equal to five times the blank concentrations and were qualified as not detected and flagged “U.”

4.2.2.3 Laboratory Control Samples

LCS samples were analyzed to assess accuracy of the analytical method in the absence of matrix effects and all acceptance criteria were met with the following exception:

- Two LCS results for chromium had a recovery that was greater than the upper control limit. Fifteen associated detected sample results were qualified as estimated and flagged “J.”
- The relative percent difference (RPD) between the LCS and LCS duplicate results for lead and manganese exceeded the control limit. Twenty associated detected sample results were qualified as estimated and flagged “J.”

4.2.2.4 Matrix Spike

MS samples were analyzed as required by the analytical methods to assess accuracy and to identify possible matrix effects associated with the samples. Only the “parent” samples are qualified for MS issues, but data users should take into consideration low spike recoveries when evaluating other sample

locations. In some cases, other laboratory samples were used to fulfill the laboratory's QC batch requirements. When samples from the site were selected for MS analyses, all acceptance criteria were met.

4.2.2.5 Laboratory Duplicates

Laboratory duplicates were performed as required by the analytical methods to assess precision of the method. In some cases, other laboratory samples were used to fulfill the laboratory's QC batch requirements. When samples from the site were used, all precision criteria were met.

4.2.3 Chain of Custody

Required procedures were followed and were generally free of errors.

4.3 Overall Assessment

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The following summary highlights the precision, accuracy, representativeness, completeness, and comparability findings for the above-defined events:

- Precision of the data was verified through the review of the laboratory data quality indicators that include LCS and laboratory duplicate RPDs. Precision was acceptable except that several metal compounds were qualified as estimated due to LCS RPD issues.
- Accuracy of the data was verified through the review of the LCS and MS recoveries, as well as the evaluation of method and field blank data. Accuracy was acceptable except that several chromium results were qualified as estimated due to LCS recovery issues. Method and field blanks were free of contamination except that several metal compounds were qualified as not detected due to method and field blank contamination. Data users should consider the impact to any result that is qualified as estimated as it may contain a bias which could affect the decision-making process.
- Representativeness of the data was verified through the sample's collection, storage, and preservation procedures and the verification of holding-time compliance. Data were reported from analyses within the recommended holding time.
- Comparability of the data was verified through the use of standard EPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.

SECTION 5

Summary

This report summarizes data collected for the second monitoring quarter: January 16, 2018, through April 15, 2018. Field and laboratory quality assurance procedures were acceptable during this monitoring period.

SECTION 6

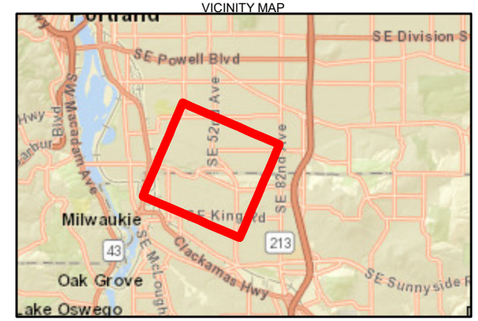
References

U.S. Environmental Protection Agency (EPA). 2016a. *National Functional Guidelines for Superfund Organic Methods Data Review.* September.

U.S. Environmental Protection Agency (EPA). 2016b. *National Functional Guidelines for Superfund Inorganic Methods Data Review.* September.

Figure

VICINITY MAP



Legend

- Air Monitoring Station

N

0 1,200 Feet

Figure 1. Monitoring Location

ch2m

Appendix A
Complete Results

Expanded Quarterly Report – Cumulative Air Quality Monitoring Results – January 16, 2018 to April 15, 2018

Springwater Corridor

Data Quality Key

Flag	Description
J1	Estimated value. Below the quantitation limit and above the detection limit.
J2	Estimated value. Flags applied during the validation process.
NA	No sample collected.
R	Data of unacceptable quality.

Comparison Values for Metals in Air

	Arsenic, Total (ng/m^3)	Beryllium, Total (ng/m^3)	Cadmium, Total (ng/m^3)	Chromium, Total (ng/m^3)	Cobalt, Total (ng/m^3)	Hexavalent Chromium Cr(VI) (ng/m^3)	Lead, Total (ng/m^3)	Manganese, Total (ng/m^3)	Nickel, Total (ng/m^3)	Selenium, Total (ng/m^3)
Urban Background from NATTS Sites	0.2 - 1.4	< MDL	0.04 - 0.5	1.6 - 4	0.05 - 0.3	0.01 - 0.08	2 - 10	3.2 - 19.5	0.8 - 2.8	0.1 - 1
DEQ Ambient Benchmark	0.2	0.4	0.6	NA	100	0.08	150	90	4	NA
Risk-based Concentrations (RBC) Acute	200	20	30	NA	NA	300	150	300	200	20,000

Statistics of Daily Values

	Arsenic, Total (ng/m^3)	Beryllium, Total (ng/m^3)	Cadmium, Total (ng/m^3)	Chromium, Total (ng/m^3)	Cobalt, Total (ng/m^3)	Hexavalent Chromium Cr(VI) (ng/m^3)	Lead, Total (ng/m^3)	Manganese, Total (ng/m^3)	Nickel, Total (ng/m^3)	Selenium, Total (ng/m^3)
Minimum Detected Amount	0.18	0.16	0.17	9.80	0.16	0.0271	0.21	0.55	1.60	NA
Maximum Detected Amount	11	0.19	2.80	51	2.50	0.1710	9.10	18	6.40	NA
Average[1]	1.07	0.16	0.33	8.84	0.25	0.0353	1.62	5.41	2.20	NA
Standard Deviation[1]	1.19	0.00	0.51	16.02	0.15	0.0347	1.80	4.11	1.16	NA
Times above the RBC acute	0	0	0	0	0	0	0	0	0	NA

[1] Calculated by using ProUCL 5, Kaplan Meier method with non-detects

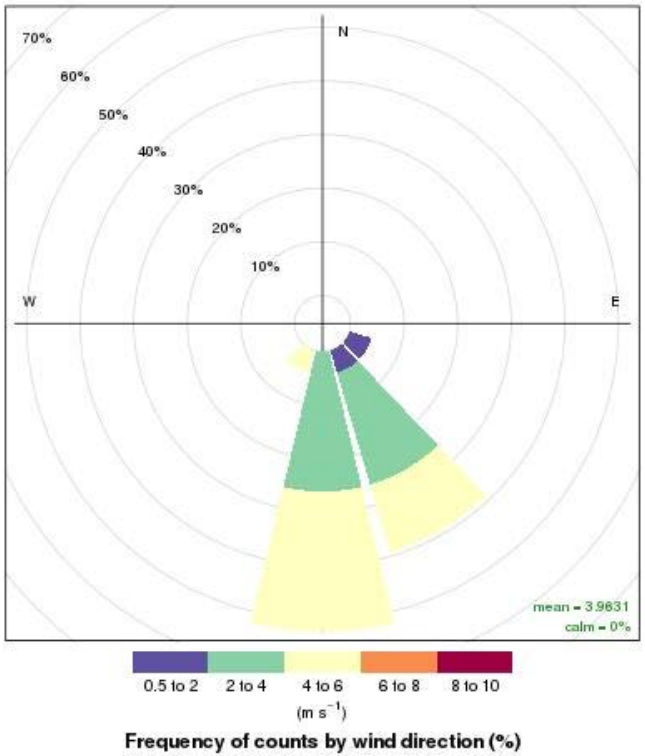
Daily Data

Sampled	Type	Arsenic, Total (ng/m^3)	Beryllium, Total (ng/m^3)	Cadmium, Total (ng/m^3)	Chromium, Total (ng/m^3)	Cobalt, Total (ng/m^3)	Hexavalent Chromium Cr(VI) (ng/m^3)	Lead, Total (ng/m^3)	Manganese, Total (ng/m^3)	Nickel, Total (ng/m^3)	Selenium, Total (ng/m^3)
01/17/2018	24 hr	0.43 J1	<0.16	<0.16	<1.6	0.16 J1	0.0354 J1	0.54	4.2	1.8 J1	<6.2
01/20/2018	24 hr	0.73	<0.16	<0.16	<1.6	<0.16	<0.0347	0.42 J1	0.78	<1.6	<6.2
01/23/2018	24 hr	0.72	0.16 J1	<0.16	<1.6	0.29 J1	<0.0347	0.77	3.8	<1.6	<6.2
01/26/2018	24 hr	0.57	0.16 J1	<0.16	<1.6	<0.16	<0.0347	0.27 J1	1.2	<1.6	<6.2
01/29/2018	24 hr	0.44 J1	<0.16	<0.16	<1.6	<0.16	<0.0347	0.47 J1	3	<1.6	<6.2
02/01/2018	24 hr	1.1	<0.16	<0.16	<1.6	<0.16	<0.0347	0.78	3.3	<1.6	<6.2
02/04/2018	24 hr	0.76	<0.16	<0.16	<1.6	<0.16	<0.0347	0.42 J1	1.4	<1.6	<6.2
02/07/2018	24 hr	1.8	<0.16	0.22 J1	<1.6	0.23 J1	<0.0347	3.3	8.2	<1.6	<6.2
02/10/2018	24 hr	2.5	<0.16	0.88	<1.6	0.26 J1	<0.0347	9.1	13	2.4 J1	<6.2
02/13/2018	24 hr	0.97	<0.16	<0.16	<1.6	0.27 J1	<0.0347	1.7	6.8	3.6 J1	<6.2
02/16/2018	24 hr	0.35 J1	<0.16	0.37 J1	<1.6	<0.16	<0.0347	0.23 J1	0.55	<1.6	<6.2
02/19/2018	24 hr	6.50	<0.16	0.17 J1	<1.6	0.37 J1	<0.0347	1.8	5.9	2 J1	<6.2
02/22/2018	24 hr	0.88	<0.16	0.20 J1	<1.6	0.16 J1	0.0444 J1	1.4	6.3	1.6 J1	<6.2
02/25/2018	24 hr	0.46 J1	<0.16	<0.16	<1.6	<0.16	<0.0347	0.35 J1	0.56	<1.6	<6.2
02/28/2018	24 hr	0.24 J1	<0.16	<0.16	<1.6	<0.16	NA	0.21 J1	2.5	<1.6	<6.2
03/03/2018	24 hr	2.6	<0.16	0.2 J1	<1.6	0.17 J1	<0.0347	3.1	6.2	2.6 J1	<6.2
03/06/2018	24 hr	0.87	<0.16	<0.16	<1.6	0.86	0.156 J1	1.7	18	6.4	<6.2
03/09/2018	24 hr	1.5	<0.16	0.32 J1	<1.6	0.18 J1	<0.0347	4.8	9.8	3 J1	<6.2
03/12/2018	24 hr	0.34 J1	<0.16	<0.16	<1.6	0.53	0.161 J1	1.2	8.8	3.7 J1	<6.2
03/15/2018	24 hr	0.46 J1	<0.16	<0.16	<1.6	0.17 J1	0.0333 J1	1 J2	7.7 J2	<1.6	<6.2
03/18/2018	24 hr	0.98	<0.16	<0.16	48	0.26 J1	0.0271 J1	2.1 J2	6.1 J2	2.30 J1	<6.2
03/21/2018	24 hr	1.1	<0.16	0.95	<1.6	0.19 J1	<0.0208	1.7 J2	<0.16	<1.6	<6.2
03/24/2018	24 hr	0.65	<0.16	<0.16	41	<0.16	<0.0394	0.81 J2	1.3 J2	<1.6	<6.2
03/27/2018	24 hr	0.43 J1	<0.16	<0.16	<1.6	<0.16	0.0278 J1	0.69 J2	8.2 J2	<1.6	<6.2
03/30/2018	24 hr	0.84	<0.16	0.33 J1	51	0.34 J1	<0.0208	1.5 J2	7.6 J2	5.3	<6.2
04/02/2018	24 hr	0.72	<0.16	0.17 J1	<1.6	0.38 J1	NA	2.6 J2	11 J2	1.6 J1	<6.2
04/05/2018	24 hr	0.84	<0.16	2.8	36	0.28 J1	<0.0208	2.4 J2	3.5 J2	<1.6	<6.2
04/08/2018	24 hr	0.97	<0.16	<0.16	<1.6	0.24 J1	0.0299 J1	0.96 J2	4.1 J2	1.9 J1	<6.2
04/11/2018	24 hr	NA	NA	NA	NA	NA	<0.0208	NA	NA	NA	NA
04/14/2018	24 hr	0.32 J1	<0.16	<0.16	42	0.16 J1	<0.0208	0.7 J2	2.9 J2	<1.6	<6.2

Wind Roses

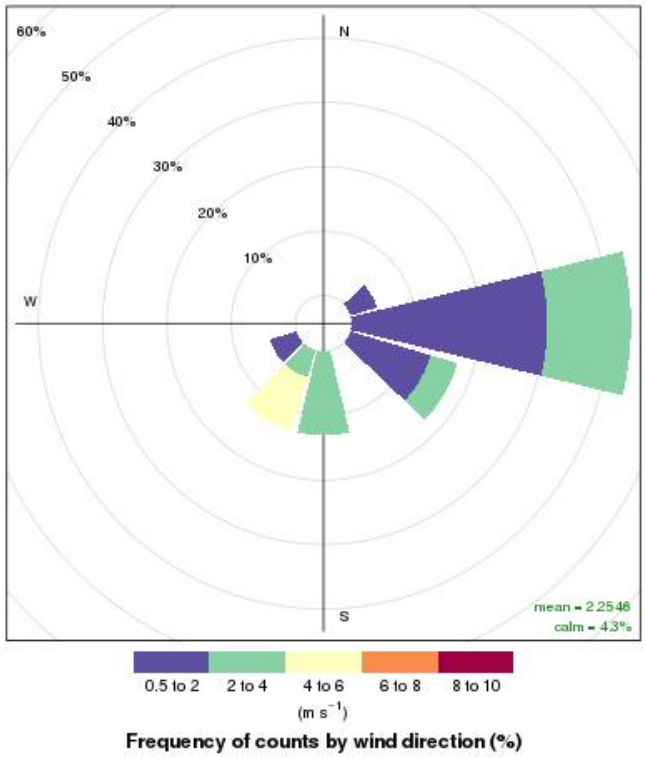
Wind speed and direction data are collected in the Oregon DEQ air quality monitoring station located in SE Lafayette in SE Portland.
Note: No wind data available for January 17 of 2018.

Date: 01-20-2018



Frequency of counts by wind direction (%)

Date: 01-23-2018



Frequency of counts by wind direction (%)

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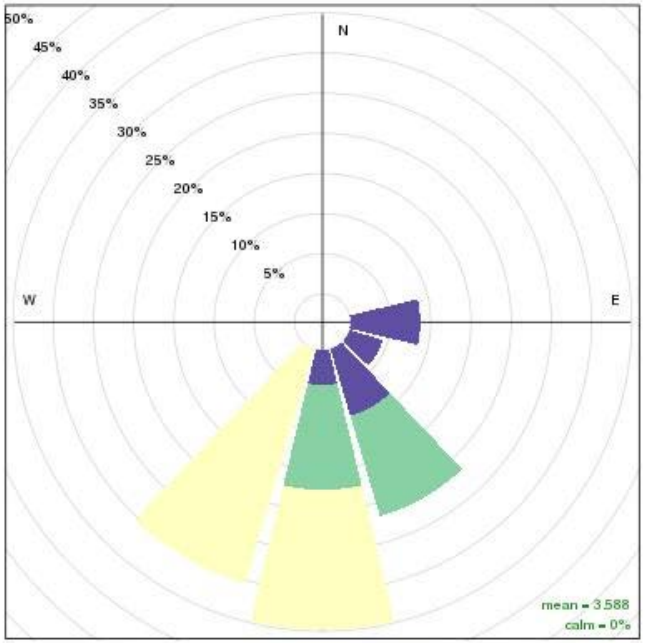

Frequency of counts by wind direction (%)

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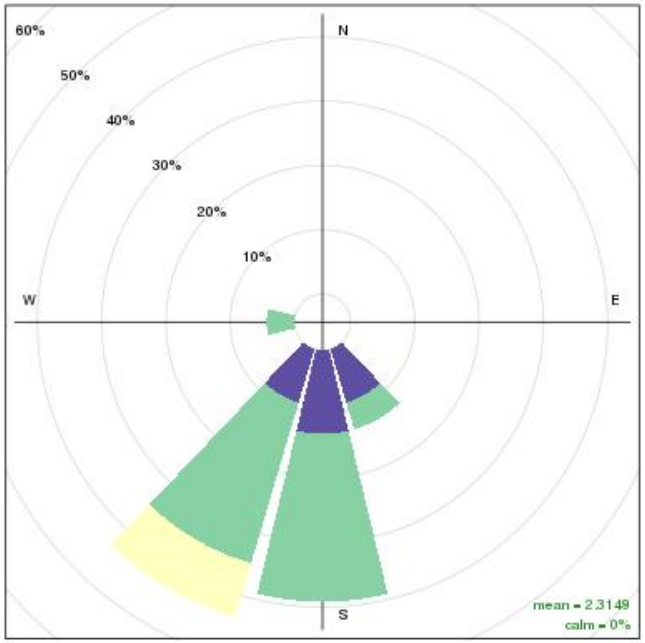
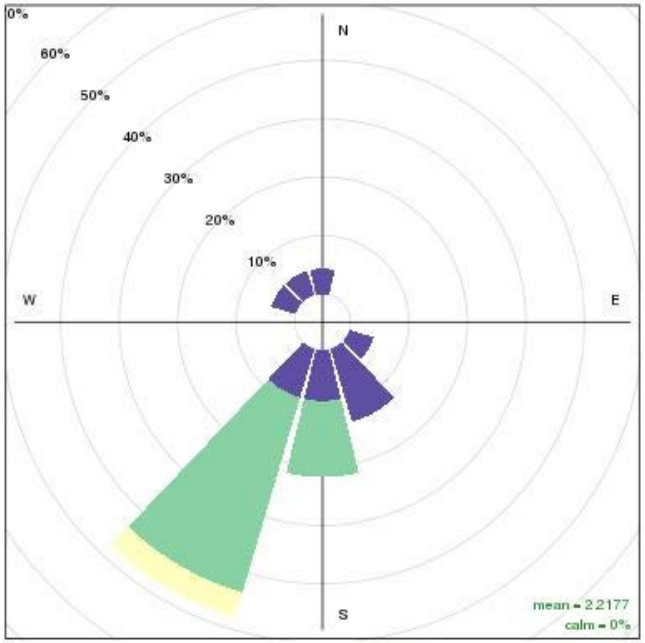
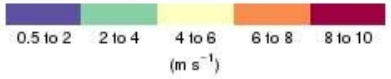


Frequency of counts by wind direction (%)

Date: 02-01-2018





Frequency of counts by wind direction (%)

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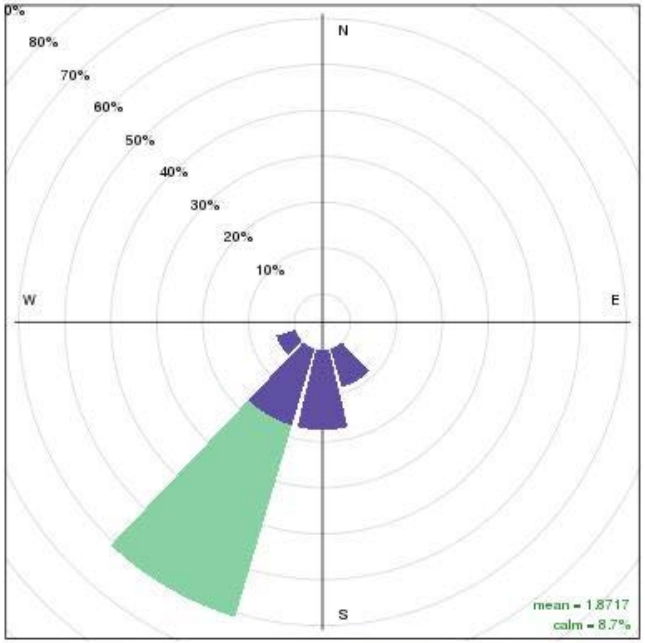

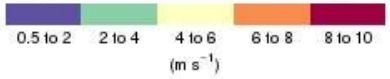

Frequency of counts by wind direction (%)

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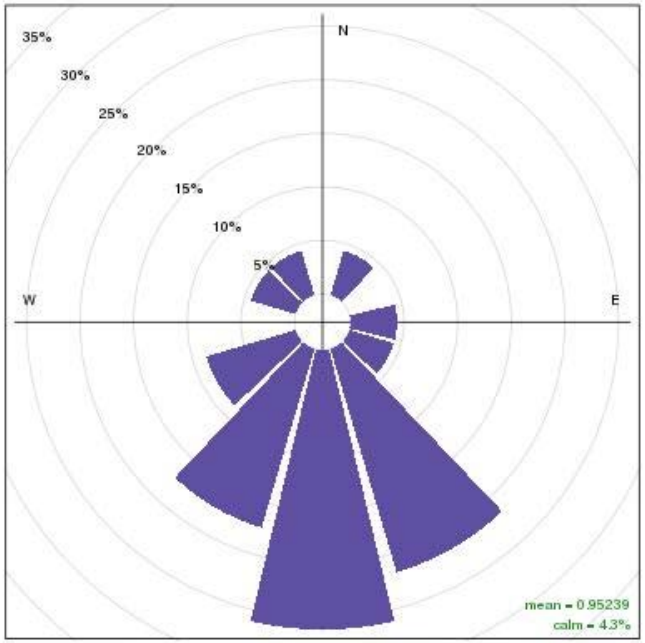

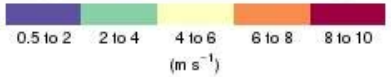

Frequency of counts by wind direction (%)

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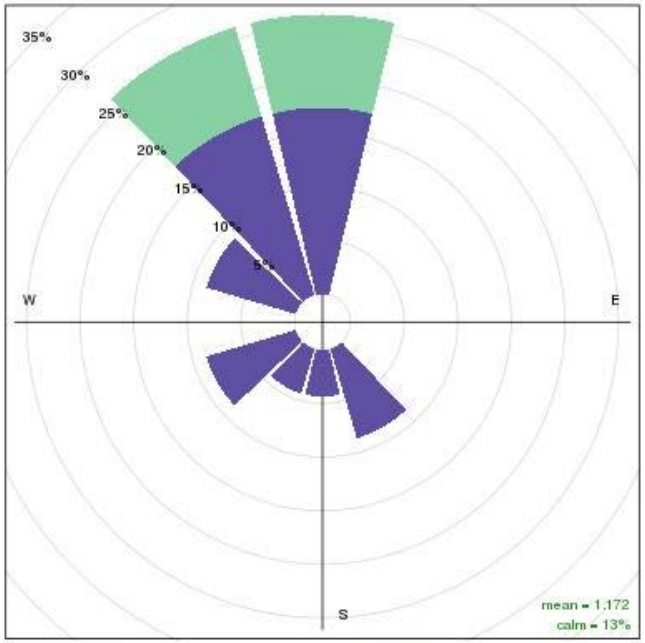

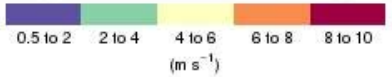

Frequency of counts by wind direction (%)

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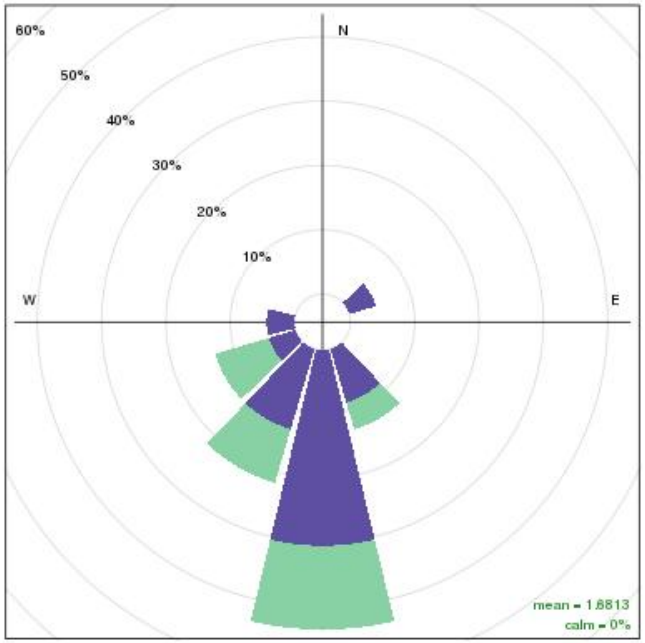

Frequency of counts by wind direction (%)

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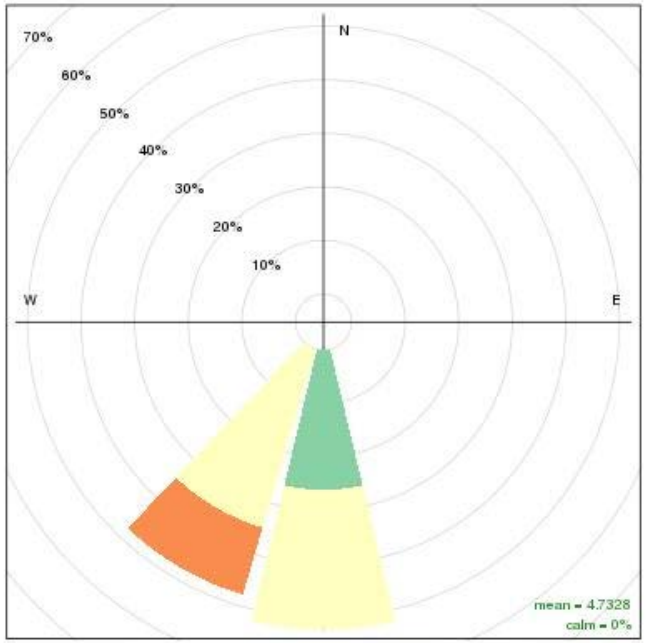

Frequency of counts by wind direction (%)

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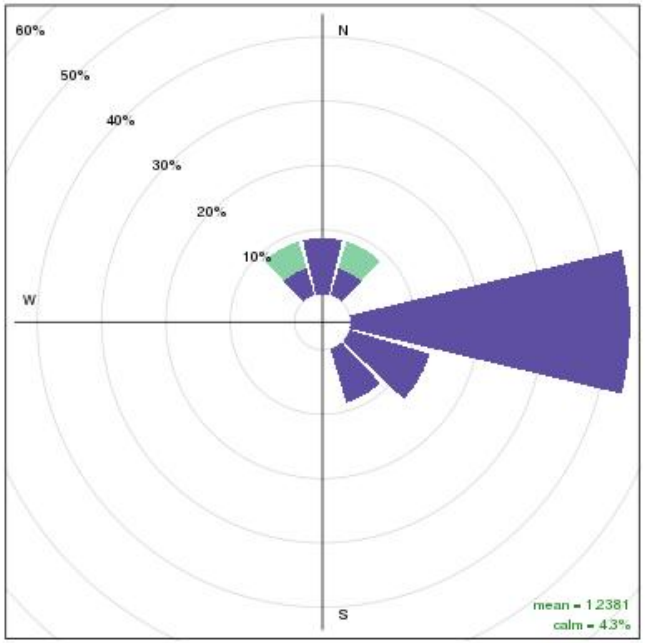
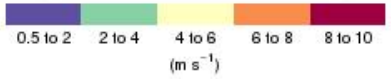
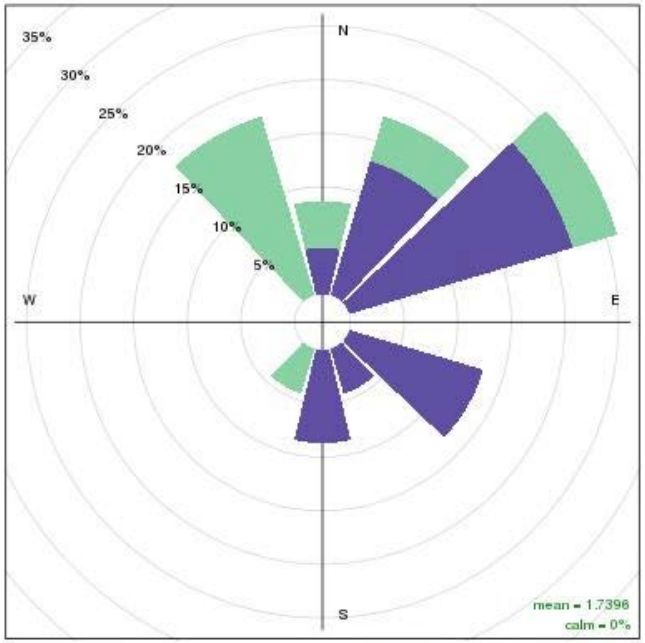
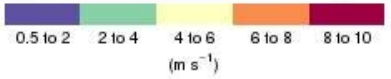




Frequency of counts by wind direction (%)

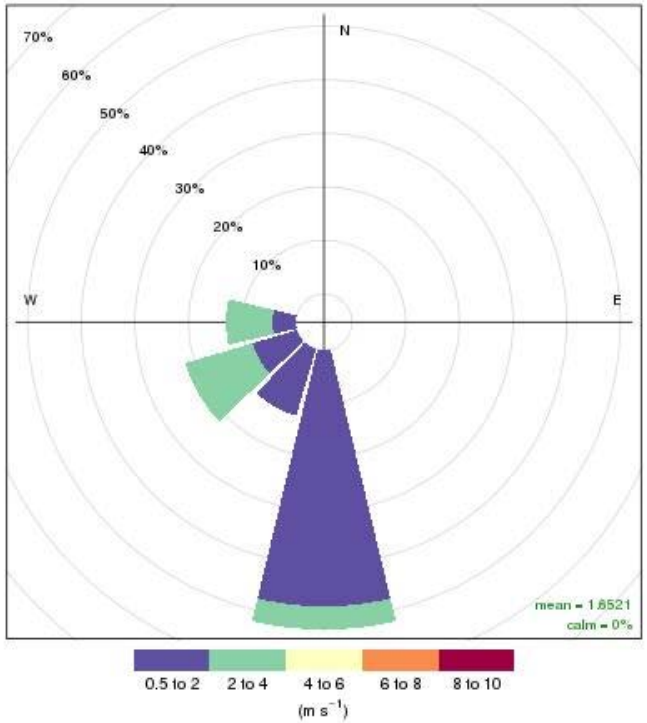
Date: 02-22-2018



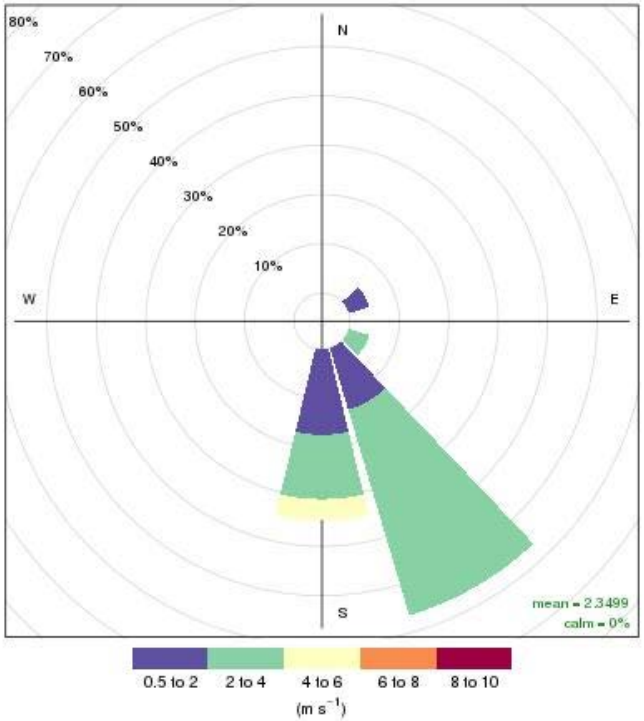


Frequency of counts by wind direction (%)

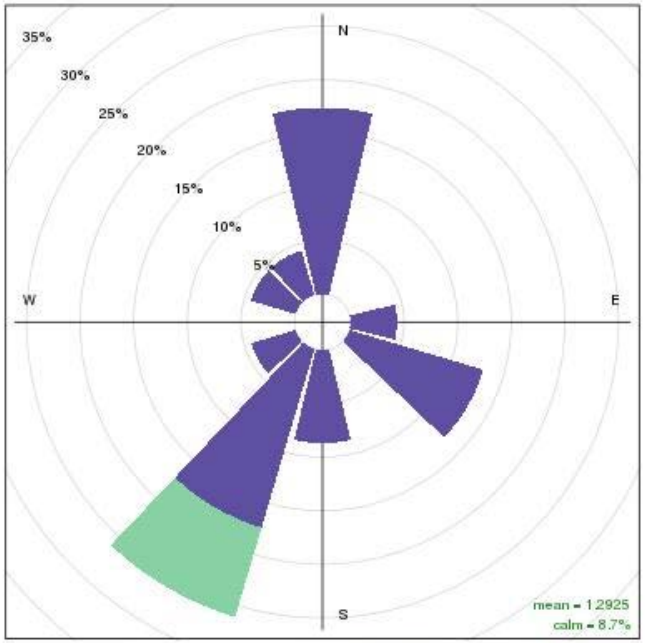
Date: 02-25-2018

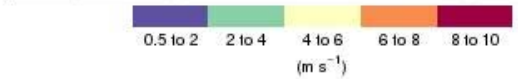


Date: 02-28-2018



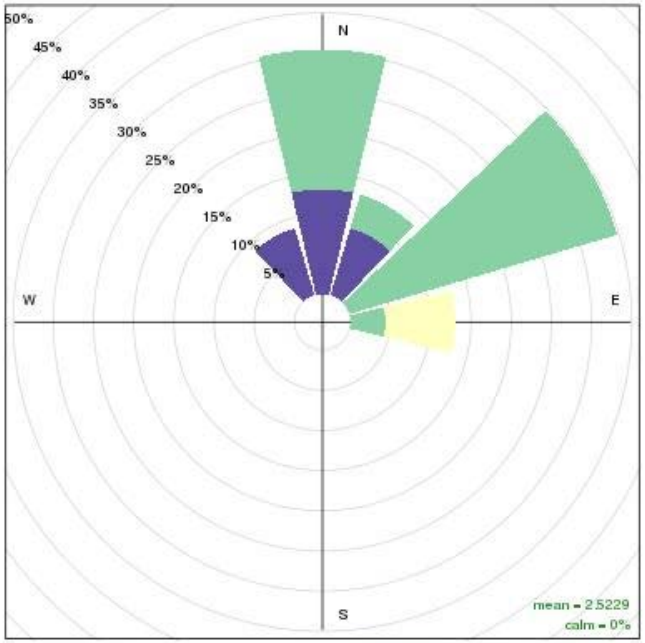
Date: 03-03-2018

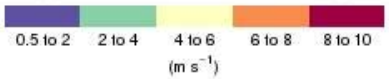




Frequency of counts by wind direction (%)

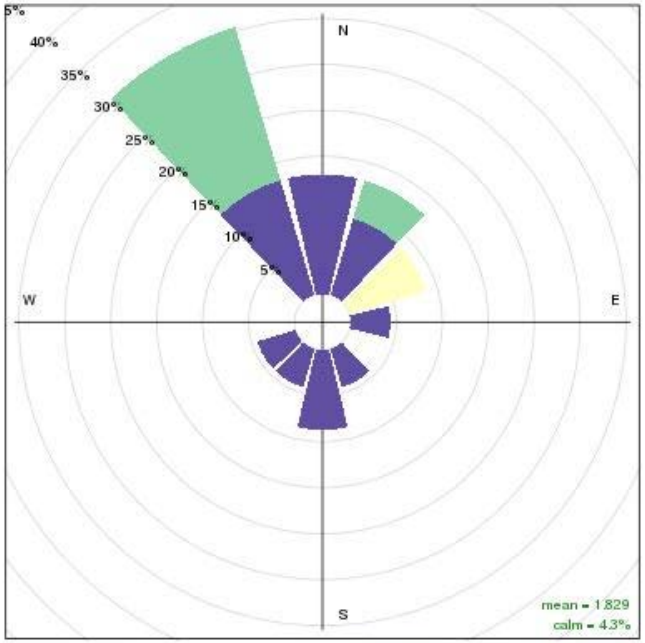
Date: 03-06-2018





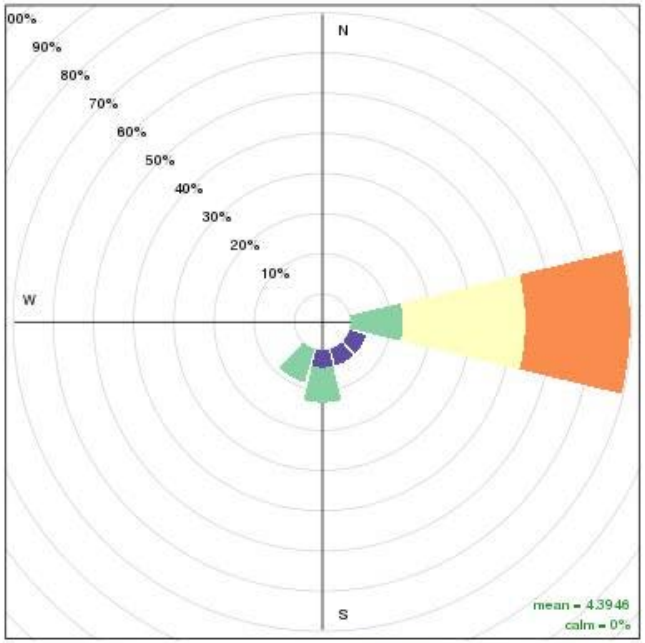
Frequency of counts by wind direction (%)

Date: 03-09-2018



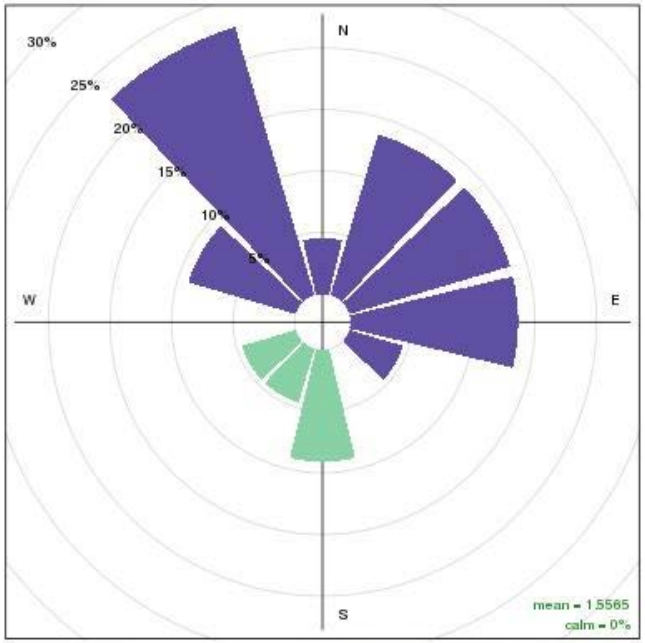
Frequency of counts by wind direction (%)

Date: 03-12-2018



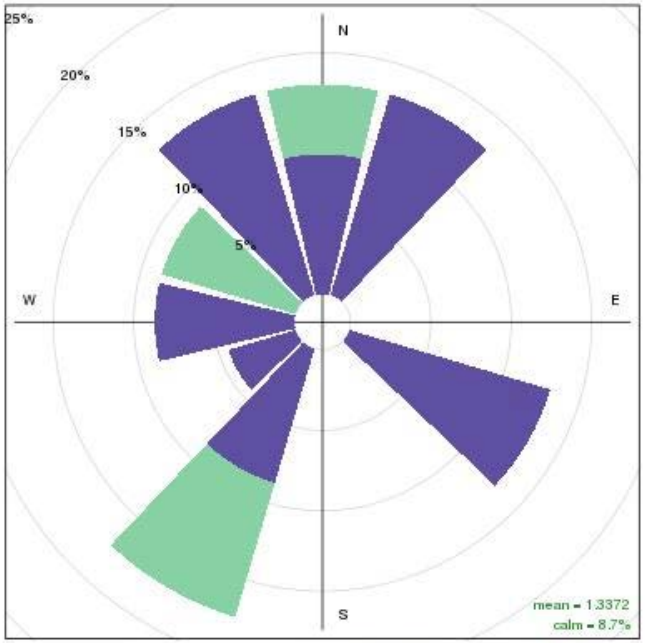
Frequency of counts by wind direction (%)

Date: 03-15-2018



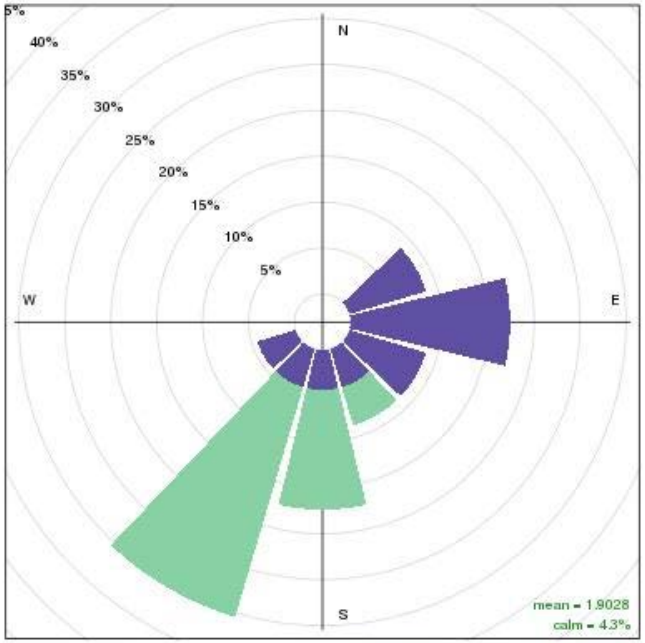
Frequency of counts by wind direction (%)

Date: 03-18-2018



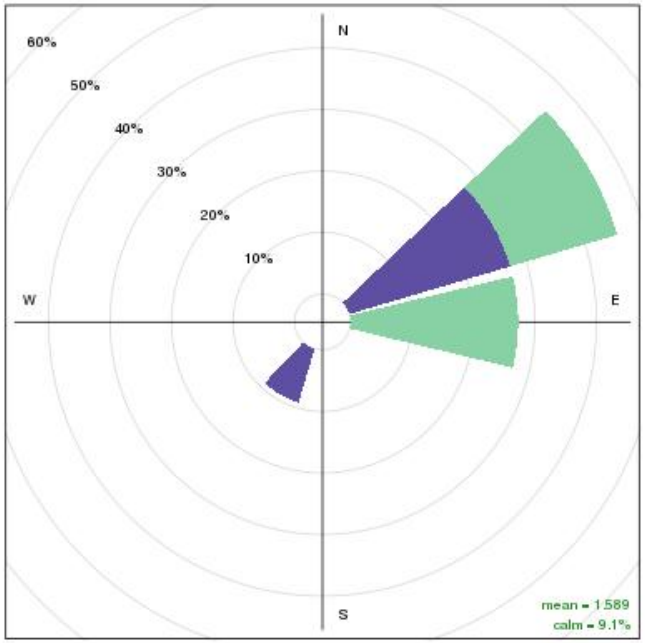
Frequency of counts by wind direction (%)

Date: 03-21-2018



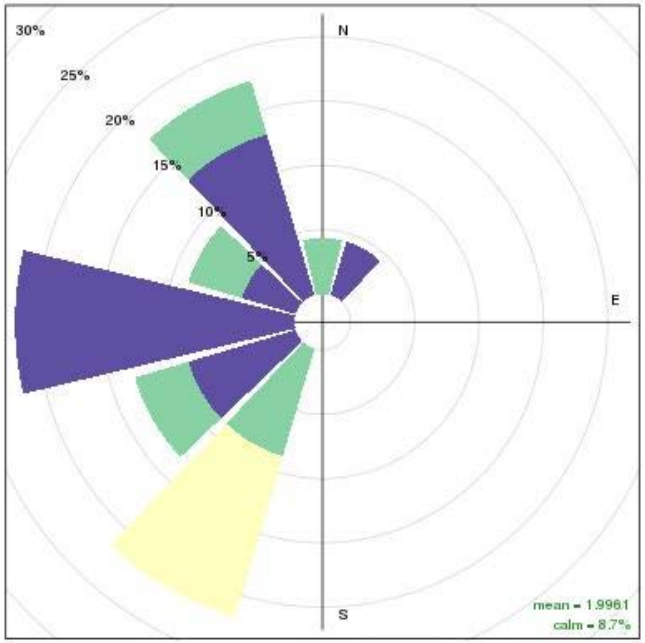
Frequency of counts by wind direction (%)

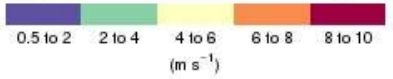
Date: 03-24-2018



Frequency of counts by wind direction (%)

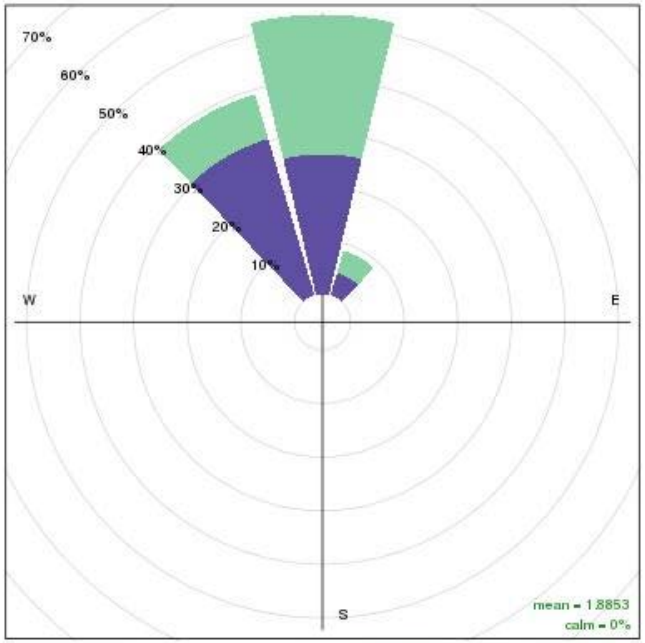
Date: 03-27-2018

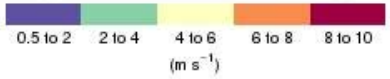




Frequency of counts by wind direction (%)

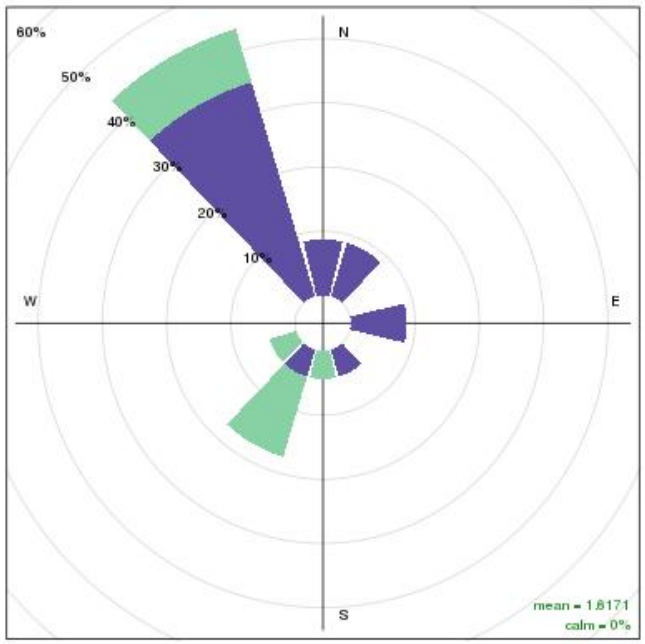
Date: 03-30-2018





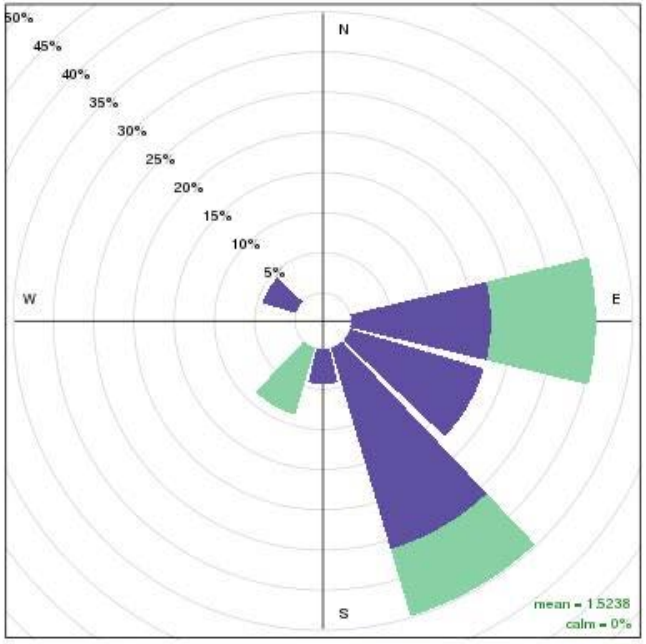
Frequency of counts by wind direction (%)

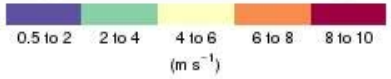
Date: 04-02-2018



Frequency of counts by wind direction (%)

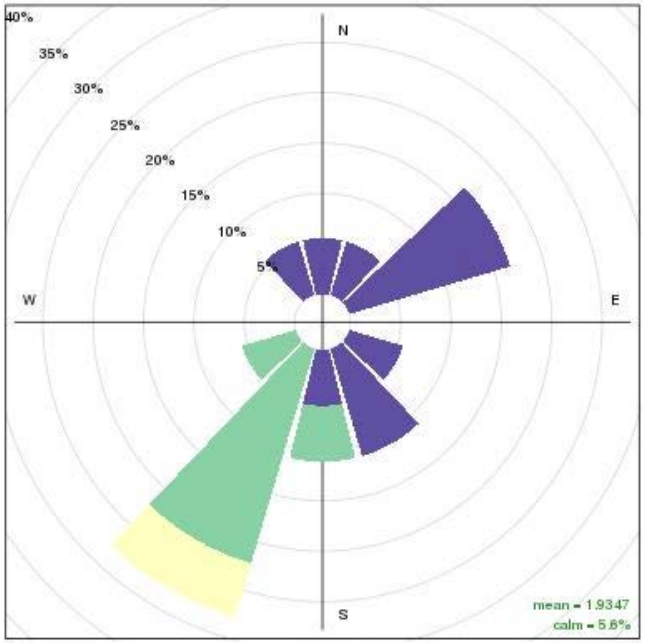
Date: 04-05-2018





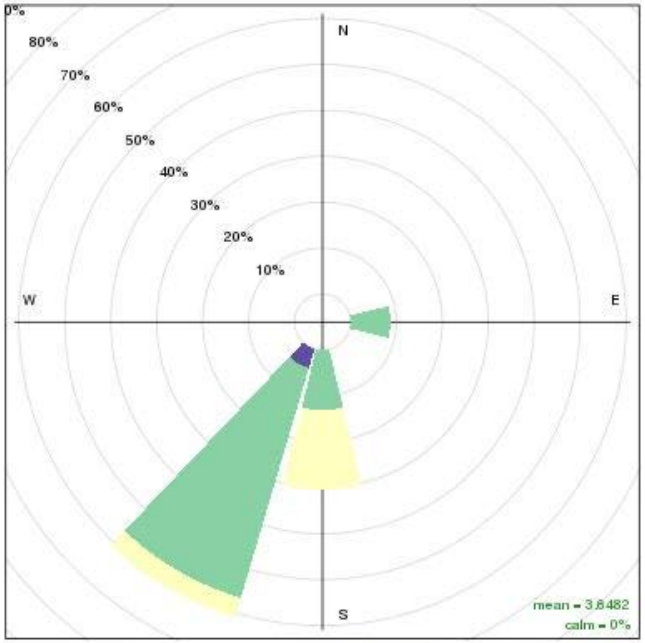
Frequency of counts by wind direction (%)

Date: 04-08-2018



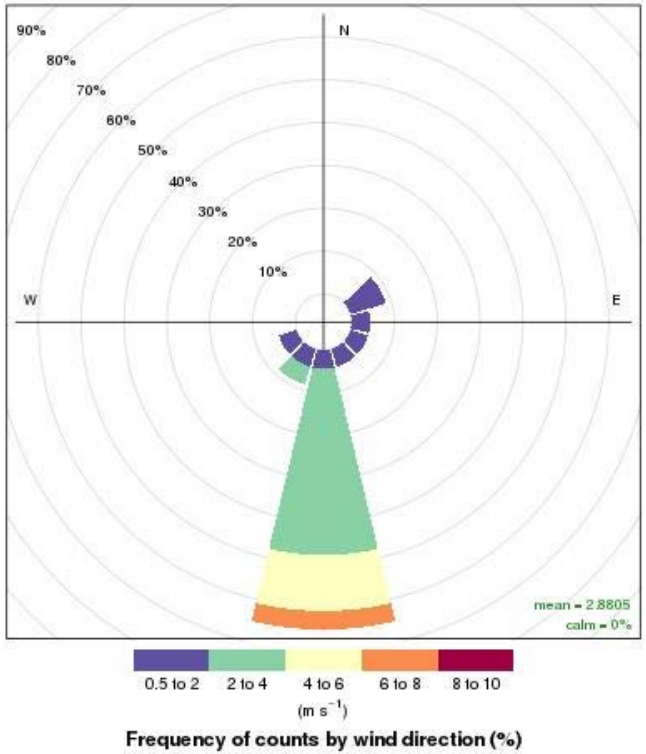
Frequency of counts by wind direction (%)

Date: 04-11-2018



Frequency of counts by wind direction (%)

Date: 04-14-2018



Frequency of counts by wind direction (%)

Appendix B
Monthly Flow Verifications

Flow Verification PM10

Site Information

Location:	M1	**Sampler:**	N-FRM	**Serial No:**	16021
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	1/24/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	12:15	**Pressure Std:**	FTS	**Serial No:**	16005

Calibration Information

Action	Indicated (Sampler)	Actual (FTS)	Error	Control Limits	Pass/Fail
Flow Rate (LPM)	16.72	16.57	-0.91	4%	pass
Temp (^{O}C)	NA	NA	NA	2^{o}C	NA
Pressure (mmHg)	NA	NA	NA	10 mmHg	NA
Clock Time	NA	NA	NA	2 min/mo	NA
Leak Check	NA	0	NA	1 LPM	NA

Flow Verification CrVI

Site Information

Location:	M2	**Sampler:**	N-FRM	**Serial No:**	16020
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	1/24/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	12:20	**Pressure Std:**	FTS	**Serial No:**	16005

Calibration Information

Action	Indicated (Sampler)	Actual (FTS)	Error	Control Limits	Pass/Fail
Flow Rate (LPM)	14.87	14.72	-1.02	4%	pass
Temp (^{O}C)	NA	NA	NA	2^{o}C	NA
Pressure (mmHg)	NA	NA	NA	10 mmHg	NA
Clock Time	NA	NA	NA	2 min/mo	NA
Leak Check	NA	0	NA	1 LPM	NA

Calibration Worksheet

Site Information

Location:	M1	**Sampler:**	N-FRM	**Serial No:**	16021
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	2/26/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	12:59	**Pressure Std:**	FTS	**Serial No:**	16005

Site Conditions

FTS Pressure (mmHg)	765	**FTS Temperature (°C)**	6
Sampler Pressure (mmHg)	765	**Sampler Temperature (°C)**	5.7
Barometric Pressure Offset	0	**Temperature Offset:**	0.3

Calibration Information

Set Flow Rate	Indicated Flow (Sampler)	Actual Flow (FTS)	Adjusted Flow	Difference	Percent Error
14.5	14.53	14.04	14.00639773	-0.0336023	-0.239332428
15.5	15.52	15.05	15.08873253	0.03873253	0.257358978
16.5	16.52	16.18	16.182	0.002	0.012360939
17.5	17.5	17.24	17.25340212	0.01340212	0.07773854
18.5	18.53	18.4	18.37946762	-0.0205324	-0.111589009

Slope	1.093267474
Intercept	-1.878778668

Calibration Worksheet

Site Information

Location:	M2	**Sampler:**	N-FRM	**Serial No:**	16020
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	2/26/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	13:10	**Pressure Std:**	FTS	**Serial No:**	16005

Site Conditions

FTS Pressure (mmHg)	765	**FTS Temperature (°C)**	5.6
Sampler Pressure (mmHg)	766	**Sampler Temperature (°C)**	5.5
Barometric Pressure Offset	-1	**Temperature Offset:**	0.1

Calibration Information

Set Flow Rate	Indicated Flow (Sampler)	Actual Flow (FTS)	Adjusted Flow	Difference	Percent Error
14.5	14.52	14.1	14.07042978	-0.0295702	-0.209717894
15.5	15.49	15.09	15.09974724	0.00974724	0.064594035
16.5	16.53	16.17	16.20334534	0.03334534	0.206217344
17.5	17.52	17.23	17.25388585	0.02388585	0.138629413
18.5	18.48	18.31	18.27259179	-0.0374082	-0.204304803

Slope	1.061152024
Intercept	-1.337497607

Calibration Worksheet

Site Information

Location:	M1	**Sampler:**	N-FRM	**Serial No:**	16021
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	3/22/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	12:35	**Pressure Std:**	FTS	**Serial No:**	16005

Site Conditions

FTS Pressure (mmHg)	753	**FTS Temperature (°C)**	10.1
Sampler Pressure (mmHg)	752	**Sampler Temperature (°C)**	8.6
Barometric Pressure Offset	1	**Temperature Offset:**	1.5

Calibration Information

Set Flow Rate	Indicated Flow (Sampler)	Actual Flow (FTS)	Adjusted Flow	Difference	Percent Error
14.5	14.52	14.32	14.33589613	0.01589613	0.111006472
15.5	15.52	15.36	15.37084322	0.01084322	0.070593894
16.5	16.5	16.4	16.38509138	-0.01490862	-0.090906247
17.5	17.49	17.47	17.409689	-0.060311	-0.345226103
18.5	18.6	18.51	18.55848028	0.04848028	0.261913969

Slope	1.034947095
Intercept	-0.691535697

	Indicated Flow (Sampler)	Actual Flow (FTS)	
Flowrate Before	16.70	16.64	lpm
Flowrate After	NA	NA	lpm

Calibration Worksheet

Site Information

Location:	M2	**Sampler:**	N-FRM	**Serial No:**	16020
Tech:	Jeff Kosta	**Flow Std:**	FTS	**Serial No:**	16005
Date:	3/22/2018	**Temp Std:**	FTS	**Serial No:**	16005
Time:	12:45	**Pressure Std:**	FTS	**Serial No:**	16005

Site Conditions

FTS Pressure (mmHg)	753	**FTS Temperature (°C)**	8.1
Sampler Pressure (mmHg)	753	**Sampler Temperature (°C)**	10.9
Barometric Pressure Offset	0	**Temperature Offset:**	-2.8

Calibration Information

Set Flow Rate	Indicated Flow (Sampler)	Actual Flow (FTS)	Adjusted Flow	Difference	Percent Error
14.5	14.53	14.32	14.32800233	0.00800233	0.055882177
15.5	15.54	15.36	15.37149863	0.01149863	0.074860897
16.5	16.5	16.38	16.36333671	-0.01666329	-0.101729507
17.5	17.52	17.45	17.41716466	-0.03283534	-0.188168141
18.5	18.51	18.41	18.43999767	0.02999767	0.162942272

Slope	1.033164659
Intercept	-0.683880174

	Indicated Flow (Sampler)	Actual Flow (FTS)	
Flowrate Before	15.00	14.84	lpm
Flowrate After	NA	NA	lpm

Appendix C
Quarterly Audit Results

Flow Audit PM10

Site Information

Location:	M1	**Sampler:**	N-FRM	**Serial No:**	16021
Tech:	Jodi Lee	**Flow Std:**	Delta Cal	**Serial No:**	605
Date:	2/9/2018	**Temp Std:**	Delta Cal	**Serial No:**	605
Time:	13:10	**Pressure Std:**	Delta Cal	**Serial No:**	605

Calibration Information

Action	Indicated (Sampler)	Actual (FTS)	Error	Control Limits	Pass/Fail
Flow Rate (LPM)	16.7	16.85	0.89	4%	pass
Temp (^{O}C)	9.7	9.8	0.10	2^{o}C	pass
Pressure (mmHg)	767	768	1.00	10 mmHg	pass
Clock Time	13:10	13:10	0.00	2 min/mo	pass
Leak Check	NA	0	NA	1 LPM	NA

Flow Audit CrVI

Site Information

Location:	M2	**Sampler:**	N-FRM	**Serial No:**	16020
Tech:	Jodi Lee	**Flow Std:**	Delta Cal	**Serial No:**	605
Date:	2/9/2018	**Temp Std:**	Delta Cal	**Serial No:**	605
Time:	13:15	**Pressure Std:**	Delta Cal	**Serial No:**	605

Calibration Information

Action	Indicated (Sampler)	Actual (FTS)	Error	Control Limits	Pass/Fail
Flow Rate (LPM)	15.03	15.34	2.02	4%	pass
Temp (^{O}C)	9.4	9.3	0.10	2^{o}C	pass
Pressure (mmHg)	768	769.5	1.50	10 mmHg	pass
Clock Time	13:15	13:15	0.00	2 min/mo	pass
Leak Check	NA	0	NA	1 LPM	pass

Appendix D
Data Qualifiers

Appendix D. Data Qualifiers

SDG	Matrix	Sample ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
1805149	AIR	M1-20180117	ICP-MS	Chromium	µg/m^3	0.042	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180120	ICP-MS	Chromium	µg/m^3	0.045	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180120	ICP-MS	Chromium	µg/m^3	0.045	U	AB>RL
1805149	AIR	M1-20180123	ICP-MS	Chromium	µg/m^3	0.026	U	AB>RL
1805149	AIR	M1-20180126	ICP-MS	Chromium	µg/m^3	0.0087	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180129	ICP-MS	Chromium	µg/m^3	0.0088	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180201	ICP-MS	Chromium	µg/m^3	0.0094	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180204	ICP-MS	Chromium	µg/m^3	0.027	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180207	ICP-MS	Chromium	µg/m^3	0.014	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180210	ICP-MS	Chromium	µg/m^3	0.025	U	AB>RL; LCS>UCL
1805149	AIR	M1-20180213	ICP-MS	Chromium	µg/m^3	0.028	U	AB>RL; LCS>UCL
1810964	AIR	M1-20180315	ICP-MS	Chromium	µg/m^3	0.026	U	AB>RL; LCS>UCL
1810964	AIR	M1-20180315	ICP-MS	Lead	µg/m^3	0.001	J2	LCSRPD
1810964	AIR	M1-20180315	ICP-MS	Manganese	µg/m^3	0.0077	J2	LCSRPD
1810964	AIR	M1-20180318	ICP-MS	Lead	µg/m^3	0.0021	J2	LCSRPD
1810964	AIR	M1-20180318	ICP-MS	Manganese	µg/m^3	0.0061	J2	LCSRPD
1810964	AIR	M1-20180321	ICP-MS	Chromium	µg/m^3	0.024	U	AB>RL; LB>RL; LCS>UCL
1810964	AIR	M1-20180321	ICP-MS	Lead	µg/m^3	0.0017	J2	LCSRPD
1810964	AIR	M1-20180321	ICP-MS	Manganese	µg/m^3	0.006	U	AB<RL; LCSRPD
	AIR	M1-20180324	ICP-MS	Lead	µg/m^3	0.00081	J2	LCSRPD
1810964	AIR	M1-20180324	ICP-MS	Manganese	µg/m^3	0.0013	J2	LCSRPD

Appendix D. Data Qualifiers

SDG	Matrix	Sample ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
1810964	AIR	M1-20180327	ICP-MS	Chromium	µg/m^3	0.031	U	LB>RL; LCS>UCL
1810964	AIR	M1-20180327	ICP-MS	Lead	µg/m^3	0.00069	J2	LCSRPD
1810964	AIR	M1-20180327	ICP-MS	Manganese	µg/m^3	0.0082	J2	LCSRPD
1810964	AIR	M1-20180330	ICP-MS	Lead	µg/m^3	0.0015	J2	LCSRPD
1810964	AIR	M1-20180330	ICP-MS	Manganese	µg/m^3	0.0076	J2	LCSRPD
1810964	AIR	M1-20180402	ICP-MS	Chromium	µg/m^3	0.033	U	LB>RL; LCS>UCL
1810964	AIR	M1-20180402	ICP-MS	Lead	µg/m^3	0.0026	J2	LCSRPD
1810964	AIR	M1-20180402	ICP-MS	Manganese	µg/m^3	0.011	J2	LCSRPD
1810964	AIR	M1-20180405	ICP-MS	Lead	µg/m^3	0.0024	J2	LCSRPD
1810964	AIR	M1-20180405	ICP-MS	Manganese	µg/m^3	0.0035	J2	LCSRPD
1810964	AIR	M1-20180408	ICP-MS	Chromium	µg/m^3	0.032	U	LB>RL; LCS>UCL
1810964	AIR	M1-20180408	ICP-MS	Lead	µg/m^3	0.00096	J2	LCSRPD
1810964	AIR	M1-20180408	ICP-MS	Manganese	µg/m^3	0.0041	J2	LCSRPD
1810964	AIR	M1-20180414	ICP-MS	Lead	µg/m^3	0.0007	J2	LCSRPD
1810964	AIR	M1-20180414	ICP-MS	Manganese	µg/m^3	0.0029	J2	LCSRPD
1807538	AIR	M1-2018216	ICP-MS	Chromium	µg/m^3	0.035	U	LB>RL
1807538	AIR	M1-2018219	ICP-MS	Chromium	µg/m^3	0.034	U	LB>RL
1807538	AIR	M1-2018222	ICP-MS	Chromium	µg/m^3	0.028	U	LB>RL
1807538	AIR	M1-2018225	ICP-MS	Chromium	µg/m^3	0.036	U	AB>RL; LB>RL
1807538	AIR	M1-2018228	ICP-MS	Chromium	µg/m^3	0.026	U	LB>RL
1807538	AIR	M1-2018303	ICP-MS	Chromium	µg/m^3	0.029	U	LB>RL
1807538	AIR	M1-2018306	ICP-MS	Chromium	µg/m^3	0.046	U	LB>RL
1807538	AIR	M1-2018309	ICP-MS	Chromium	µg/m^3	0.036	U	LB>RL
1807538	AIR	M1-2018312	ICP-MS	Chromium	µg/m^3	0.028	U	LB>RL

Validation Reasons:	
AB<RL	The analyte was detected at a concentration less than the reporting limit in the ambient field blank.
AB>RL	The analyte was detected at a concentration greater than the reporting limit in the ambient field blank.
LB>RL	The analyte was detected at a concentration greater than the reporting limit in the laboratory method blank.
LCS>UCL	The laboratory control sample was recovered greater than the upper control limit.
LCSRPD	The relative percent difference between laboratory control sample and the associated duplicate was greater than the control limit.
Validation Flags:	
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit or a detection in the samples was changed to a nondetected result, flagged “U” due to blank contamination.
J2	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
Note:	
µg/m^3	micrograms per cubic meter