Phase 1: Background Air Monitoring Summary for Seattle Iron and Metals Corporation

Prepared for

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As part of Consent Decree No. 12-01201RSM, T&B Systems conducted Phase 1 "background" air monitoring upwind of the Seattle Iron and Metals Corporation (SIM) facility in Seattle, Washington from May 8, 2019 through August 29, 2019. The monitoring effort was designed to investigate the contribution of particulate concentrations upwind (South to Southwest) of the SIM property. The following summarizes the conduct of the study and presents observations obtained from the collected data.

STUDY DESIGN

In an earlier round of sampling in 2018, a review of wind rose data from the Seattle-Tacoma airport was performed to identify appropriate locations for installing, at the time, two fenceline monitor systems which were operated in 2018 at the SIM facility.[1] For example, **Figure 1** shows a wind rose for the month of May for the area taken from data collected at Seatac. Based on this as well as data collected at the SIM site in 2018 – which are consistent (as would be expected, since average winds collected over long periods of time do not vary significantly), the greatest frequency of winds come from a southwest to south direction. The goal of the Phase 1 2019 monitoring effort was to select three sites that would measure "background" level impacts of particulate matter including total suspended particulate (TSP) and particulate matter (PM) of 2.5 micrometers or less referred to as $PM_{2.5}$ and to conduct sample collection of polychlorinated biphenyl (PCB) and dioxin compounds upwind of the SIM facility. In addition, the Teflon sample filters from each of the TSP samplers were sent at the end of the monitoring period to a laboratory and analyzed for metals. **Figure 2** shows the monitoring locations relative to the SIM facility. The three background monitoring sites are referred to as Heiser, Residential and City. **Table 1** provides the coordinates for each of the monitoring locations.

METHODOLOGY

Table 2 lists the equipment used for the monitoring effort. The core measurements of the study were continuous measurements of TSP and $PM_{2.5}$ concentrations, continuous meteorology at one of the sites and sample media used to collect PCB and dioxin compounds. Thermo Personal Data Ram (pDR) Model 1500 samplers were used for all TSP and $PM_{2.5}$ measurements and SKC pumps were used with PUF media for the collection of PCB and dioxin compounds. Performance specifications of the equipment are presented in **Table 3**.

[1] This sampling is not the subject of or contained in this report.

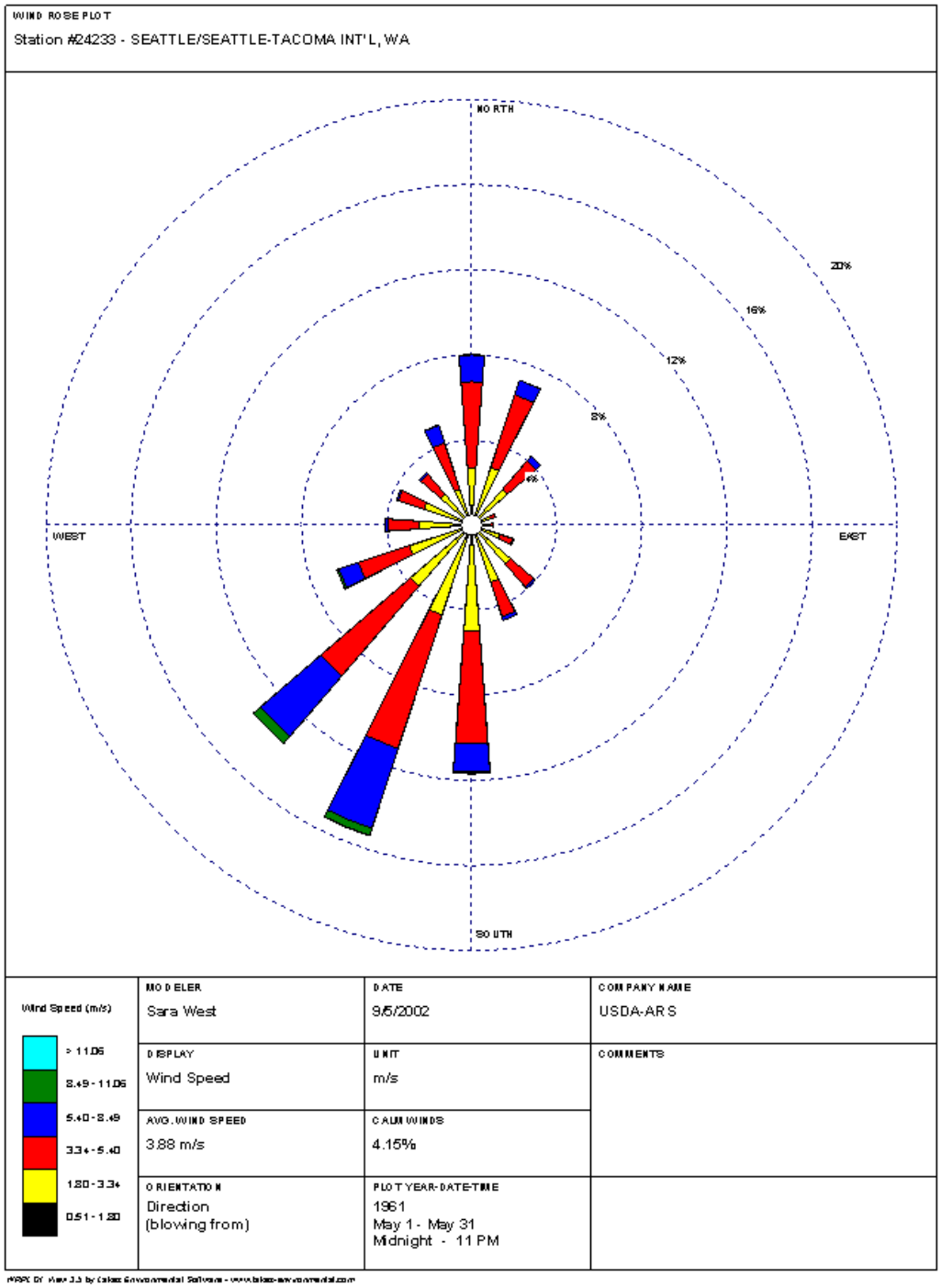


Figure 1. Seattle-Tacoma Airport Wind Rose (1961-1990)

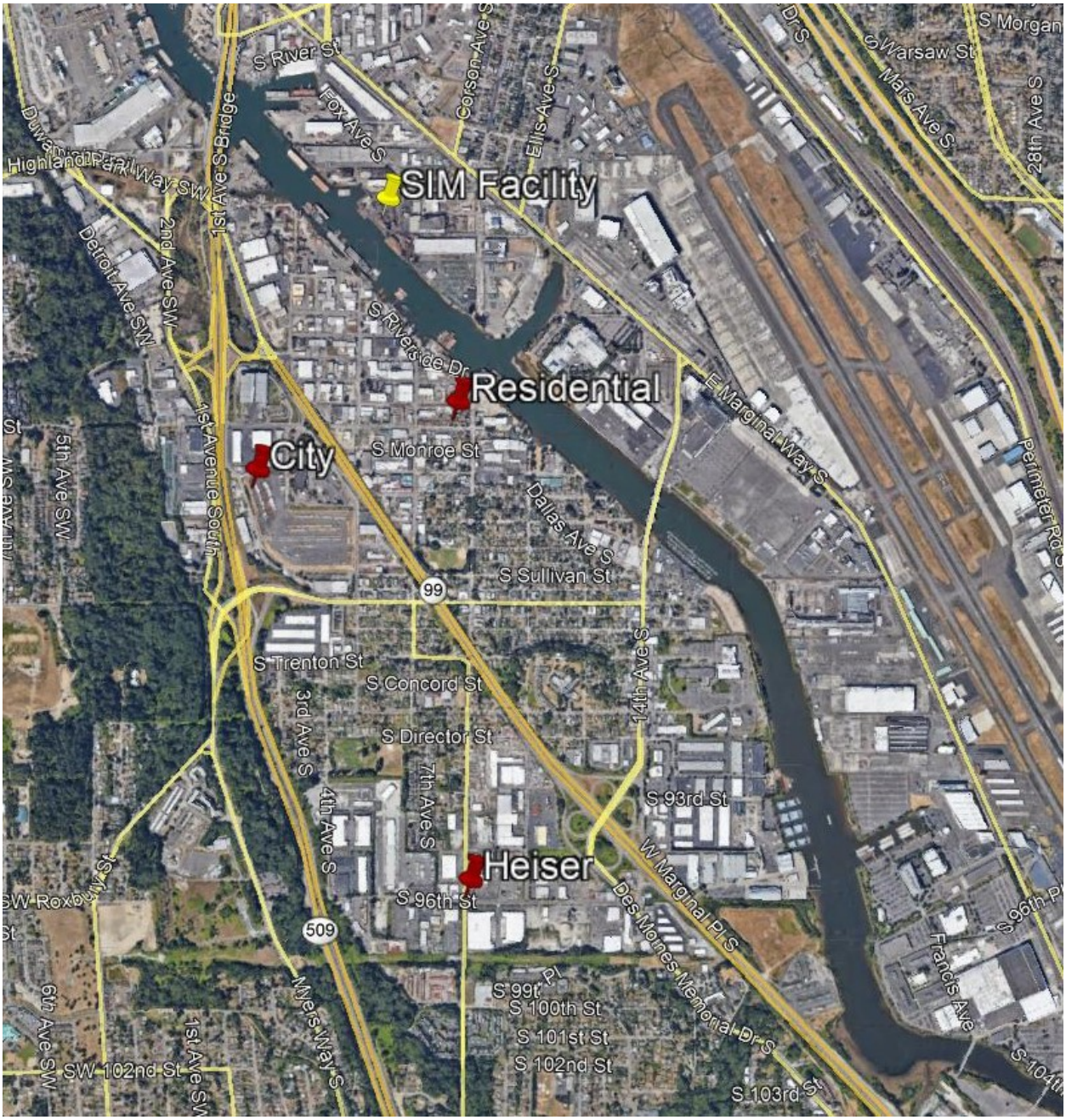


Figure 2. 2019 "Background" Monitoring Locations

Table 1. Site Coordinates

City	47.531368° -122.331062°
Heiser	47.517208° -122.323181°
Residential	47.532211° -122.323769°

Table 2. Instrumentation

Measurement	Site(s)	Make/Model	Sampling parameters	Comments
Wind Speed and Direction	Heiser	RM Young Wind Monitor	1-s scans (not recorded but used in the calculations), 5-min, hourly, 24-hour averages, vector and scalar wind calculations	Sensor was located on a tripod with a height of about 4 meters.
Ambient Temperature/Relative Humidity	Heiser	RM Young 41382VC	1-s scans (not recorded but used in the calculations), 5-min, hourly, 24-hour averages	Sensors were housed in a radiation shield located on a tripod at a height of about 2 meters.
Precipitation	Heiser	Texas Electronics TR-525M	1-s scans (not recorded but used in the calculations), 5-min, hourly, 24-hour totals	Sensor was located on a tripod at a height of about 2 meters.
PM (TSP)	Heiser, City & Residential	Thermo pDR-1500 with TSP cyclone	1-s scans (not recorded but used in the calculations), 5-min, hourly, 24-hour concentrations	Sample inlet height of about 2 meters. Nominal sample flow of 2.0 lpm
PM ($PM_{2.5}$)	Heiser, City & Residential	Thermo pDR-1500 with $PM_{2.5}$ cyclone	1-s scans (not recorded but used in the calculations), 5-min, hourly, 24-hour concentrations	Sample inlet height of about 2 meters. Nominal sample flow of 1.5 lpm
PCB/Dioxins	Heiser, City & Residential	SKC Personal Sample Pump with PUF sample media	Approximately 1-week samples were collected over the study period and analyzed by ALS Life Sciences	Sample inlet height of about 2 meters. Nominal sample flow of 1.0 lpm PCBs analyzed using USEPA Method 1668 and dioxins using USEPA Method 8290A
Metals	Heiser, City & Residential	TSP pDR-1500 Teflon sample filters	Sample filters collected PM over the entire study period and analyzed by CHESTER LabNet	Metals analyzed using X-Ray Fluorescence EPA-IO-3.3
Data recording	Heiser, City & Residential	Campbell Scientific CR1000 and CR300	1-s scans and 5-min, hourly and 24-hour averages/totals	
Cellular telemetry	Heiser, City & Residential	Sierra Wireless AirLink Raven XT and Campbell Scientific CELL210		

Table 3. pDR-1500 specifications.

Concentration measurement range (auto-ranging)	0.001 to 400 mg/m3
Scattering coefficient range	1.5 x 10-6 to 0.6 m-1 (approx.) @ λ = 880 nm
Precision/repeatability over 30 days (2-sigma)	± 2% of reading or ± 0.005 mg/m3, whichever is larger, for 1-second averaging time ± 0.5% of reading or ± 0.0015 mg/m3, whichever is larger, for 10-second averaging time ± 0.2% of reading or ± 0.0005 mg/m3, whichever is larger, for 60-second averaging time
Accuracy	± 5% of reading (± precision) traceable to SAE Fine Test Dust
Resolution	0.1 µg/m3
Particle size range of maximum response	Total Suspended Particulate

The pDR sampler uses an optical method to detect particles, providing a continuous measurement of TSP and $PM_{2.5}$ concentrations. While the sampler does not have EPA Federal Reference Method (FRM) or Federal Equivalent Method (FEM) status for the measurement of TSP and $PM_{2.5}$, studies have shown that readings from the pDR correlate very well with those from FEM or FRM instrumentation, and therefore provide an economical means of measuring TSP and $PM_{2.5}$ concentrations for this type of application.

FIELD OPERATIONS

The Heiser and Residential sites were installed on May 8 and the City site was installed on May 9, 2019, with continuous PM and meteorological measurements starting on these dates. The PCB and dioxin monitoring commenced at each of the sites on June 10, 2019.

The Heiser site was installed at the Heiser Body Company and was powered by AC power using an extension cord with a battery backup. The pDRs and SKC pumps were housed in the CR1000 datalogger enclosure and was attached to the meteorological tripod. The Wind Monitor sensor orientation was verified with a GPS and oriented to true North. The PM sample inlets were attached to the mast with the inlet located about 1.5 meters under the Wind Monitor. Funnels were attached to prevent rain water from entering the sample lines. **Figure 3** shows the installed system at Heiser.

The City site was installed at the South Seattle Hazardous Waste Facility. The pDRs were installed within the CR300 datalogger enclosure which was mounted on a fence post within the facility. The PM sample inlets were attached to the fencepost at a height of approximately 2 meters. The site was powered by AC power using an extension cord with a battery backup. Funnels were attached to prevent rain water from entering the sample lines**. Figure 4** shows the installed system at the City site.

The Residential site was installed at a residence. The pDRs were installed within the CR300 datalogger enclosure which was placed on a table located in the backyard of the home. The PM sample inlets were attached to a small tripod at a height of approximately 2 meters. The site was powered by AC power using an extension cord with a battery backup. Funnels were attached to prevent rain water from entering the sample lines**. Figure 5** shows the installed system at the Residential site.

Quality Control and Data Validation

Weekly checks of the sampling systems were conducted by Floyd Snider personnel during the 10-week sampling period. These checks included the following:

- Visual check that nothing had changed at the site
- Flow check of the pDR and SKC samplers
- Zero check of the pDR response

Over the period of the study, the sites exhibited increased zero baseline responses. The instruments were “re-zeroed” several times over the course of the study period. Additionally, several of the pDR and SKC pump sample flow rates needed to be adjusted. All adjustments were documented on log sheets by Floyd Snider personnel. The site logs can be found at the end of this report.

In addition to the instrument zero and flowrate drift, Floyd Snider personnel were needed to periodically reset the pDR at the sites as communications from the pDR to the datalogger occasionally would fail. Additionally, some of the rental pDR units experienced malfunctions that could not be addressed/repaired in the field and needed to be swapped with different rental units. These periods are noted in the site logs.

All data from the sites were uploaded via cellular modem to T&B’s Vista Data Vision web-based data management system, where they were reviewed on at least a once-daily basis for instrument related

problems, as well as any other issues that could influence the achievement of the study goals. In addition, alarm notifications were used to push email and text alert notifications if any problems were detected.

Figure 3. Heiser site monitoring system

Figure 4. City site monitoring system

Figure 5. Residential Site Monitoring System

DATA SUMMARY

Data collected during the study are summarized below:

- **Table 4** provides the 5-min maximum, 60-minute average and maximum and 24-hour maximum concentrations observed at the sites for the study period and includes the data capture percentage. In addition, the net mass total for the entire study period for each of the sites have been included from the analysis of each of the TSP sample filters analyzed by Chester Labnet.
- **Figures 6 – 9** present the 60-minute and 24-hour averaged TSP and $PM_{2.5}$ concentrations from all sites.
- **Figures 10** presents the 5-minute, and 60-minute averaged TSP and $PM_{2.5}$ pollution roses from all sites.
- **Figure 11** presents the wind rose for the study period from the Heiser site and **Figures 12 – 15** present the meteorological hourly average data from the Heiser site.
- The metals results from the TSP Teflon filters analyzed by CHESTER LabNet is provided at the end of this report.
- The PCB/dioxin results analyzed by ALS Life Sciences laboratory will be provided by Floyd Snider.

Table 4. Average and maximum concentrations for the study period

	City Site TSP Concentrations (µg/m^3)	City Site $PM_{2.5}$ Concentrations (µg/m^3)
5-min maximum	265.5	161.3
60-min maximum	170.6	98.8
24-hr maximum	26.5	16.0
Average study concentration	9.9	6.8
TSP Teflon filter net mass total (Chester LabNet filter ID 18-T125)	1,573	
Data Capture	*80.7%*	*90.6%*
	Heiser Site TSP Concentrations (µg/m^3)[2]	Heiser Site $PM_{2.5}$ Concentrations (µg/m^3)
5-min maximum	542.9	161.3
60-min maximum	46.0	477.9
24-hr maximum	24.1	29.3
Average study concentration	10.2	5.9
TSP Teflon filter net mass total (Chester LabNet filter ID 18-T123)	2,329	
Data Capture	*87.5%*	*78.0%*
	Residential Site TSP Concentrations (µg/m^3)	Residential Site $PM_{2.5}$ Concentrations (µg/m^3)
5-min maximum	405.1	371.9
60-min maximum	99.6	71.9
24-hr maximum	29.1	17.8
Average study concentration	10.8	5.8
TSP Teflon filter net mass total (Chester LabNet filter ID 18-T124)	3,299	
Data Capture	*99.9%*	*99.9%*

[2] Review of the data showed that the Heiser TSP sampler would frequently crash when a high spike in concentration was encountered (most notably, during the 4th of July when the $PM_{2.5}$ maximums occurred), affecting the representativeness of the TSP maximums at this site.

Study-long average filter-based TSP concentrations were estimated using sampler flow rates data to calculate the total volume of air drawn by the samplers. Using notes in the station logs to establish assumptions on the operational state of each sampler, the following concentrations were derived for TSP:

- City – 6.5 $\mu g/m^3$
- Heiser – 7.2 $\mu g/m^3$
- Residential – 10.2 $\mu g/m^3$

In reviewing this data, it is important to note that the Residential TSP sampler remained issue-free throughout the study period. This explains the similarity between the filter-based average concentration (10.2 $\mu g/m^3$) and the sampler reported average study concentration (10.8 $\mu g/m^3$) for this site. In contrast, both the City and Heiser filter-based measurements are impacted by periods of missing data and varying sampler flow rates that introduce uncertainty into the filter measurements, making comparisons less conclusive. Even so, the calculated filter based concentrations are still within about 3 $\mu g/m^3$ of the sampler reported average study TSP concentrations presented in Table 4.

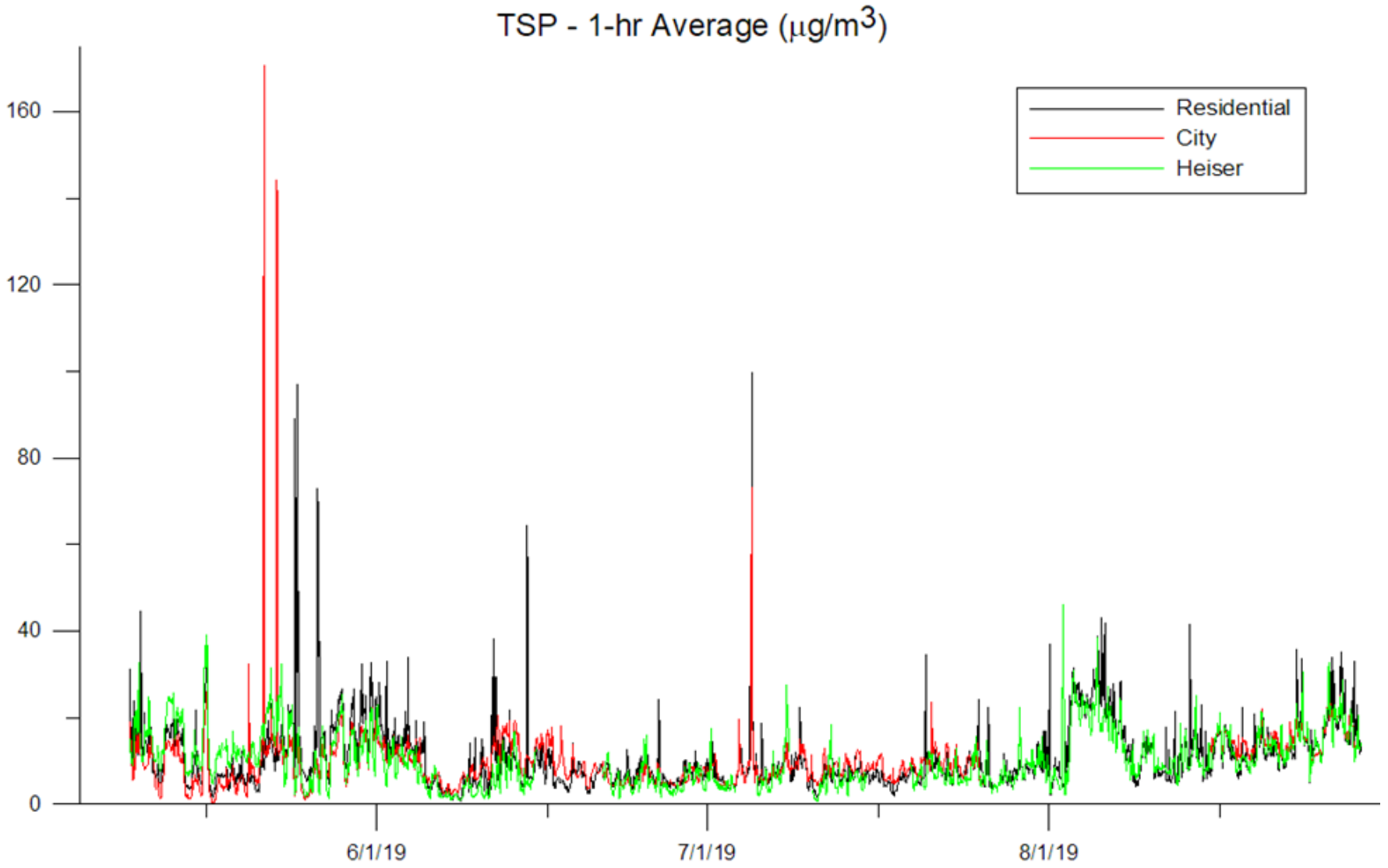


Figure 6. 1-Hour average TSP concentrations for the study period

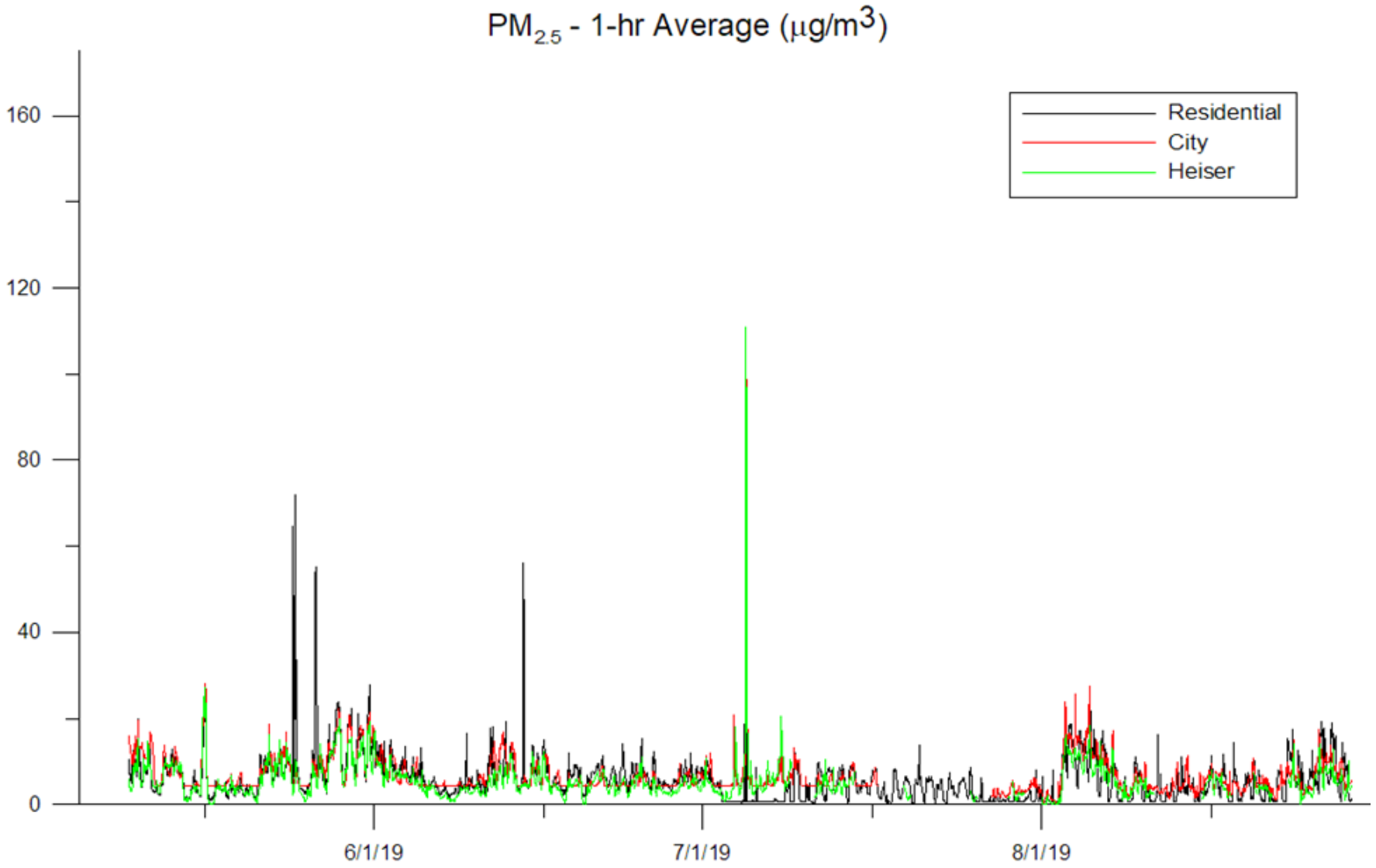


Figure 7. 1-Hour average $PM_{2.5}$ concentrations for the study period

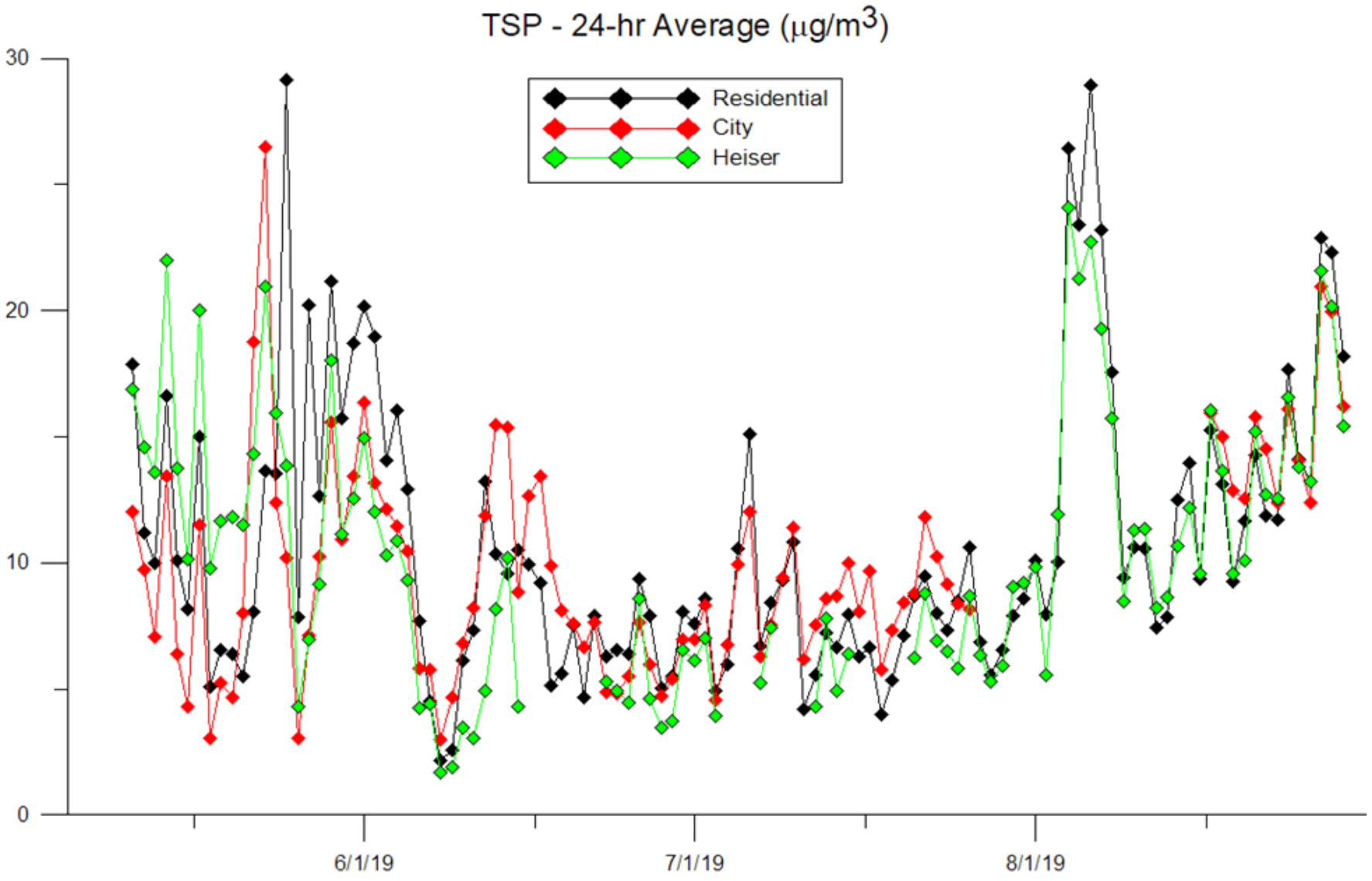


Figure 8. 24-hr average TSP concentrations for the study period

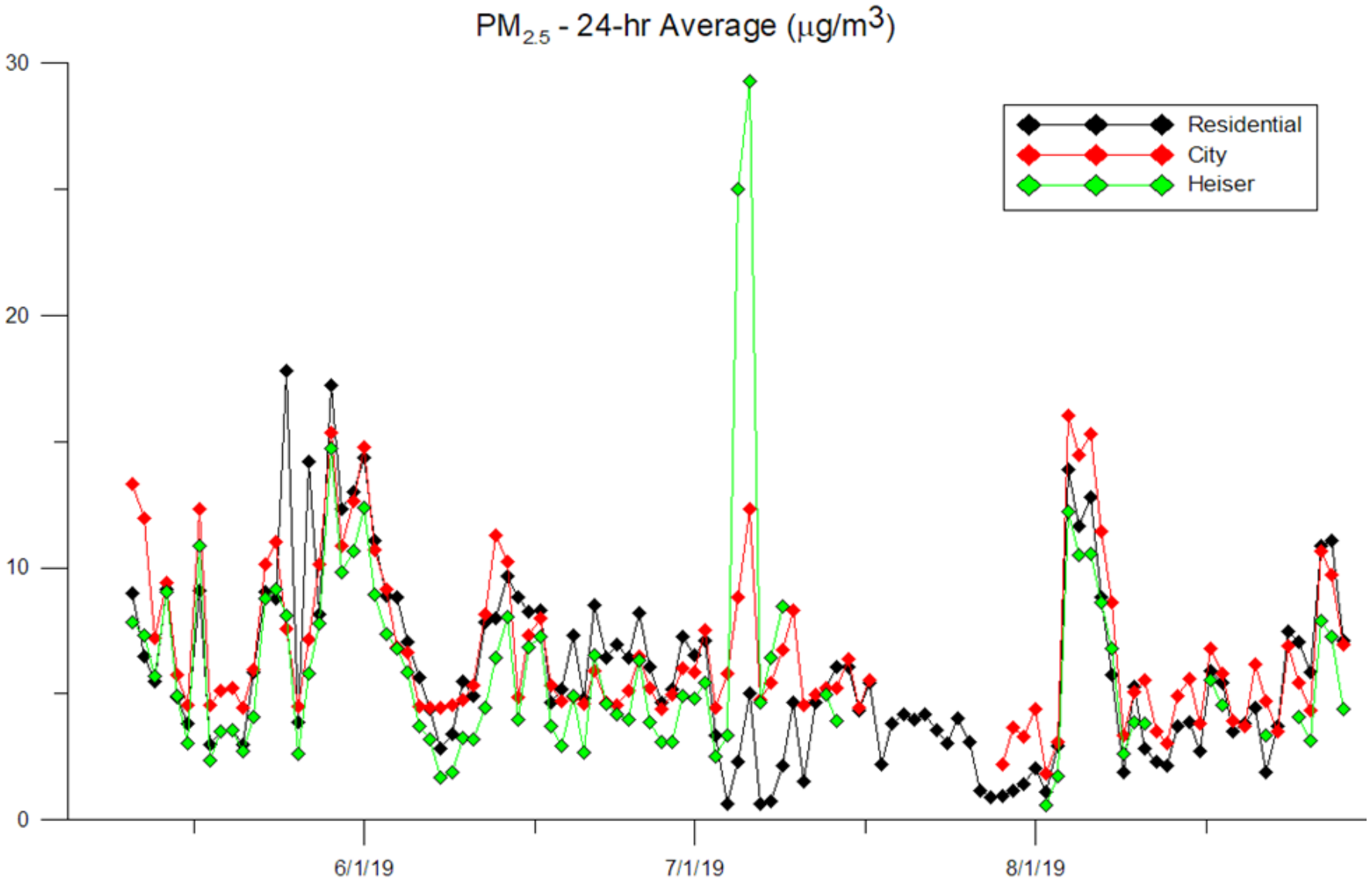
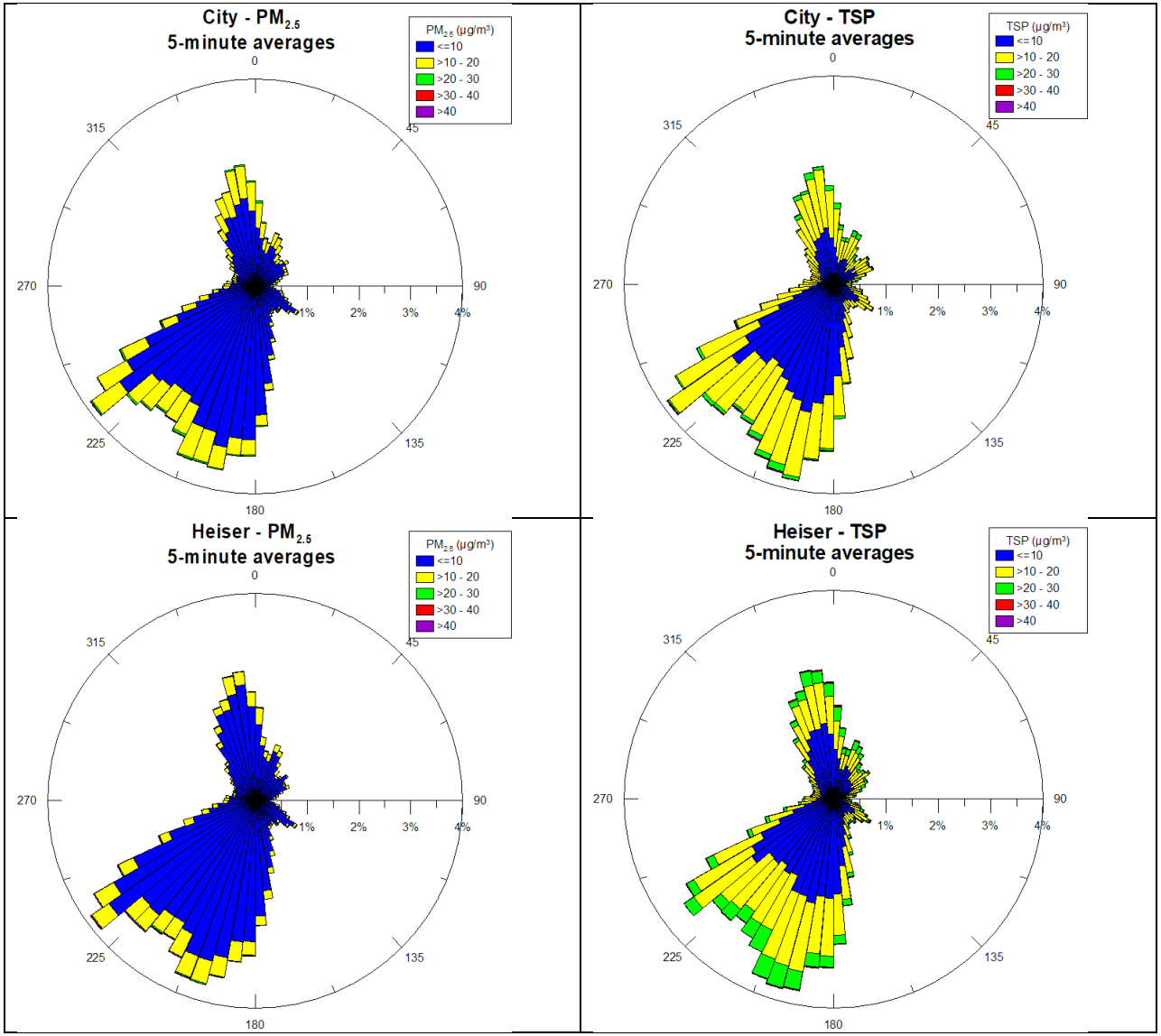
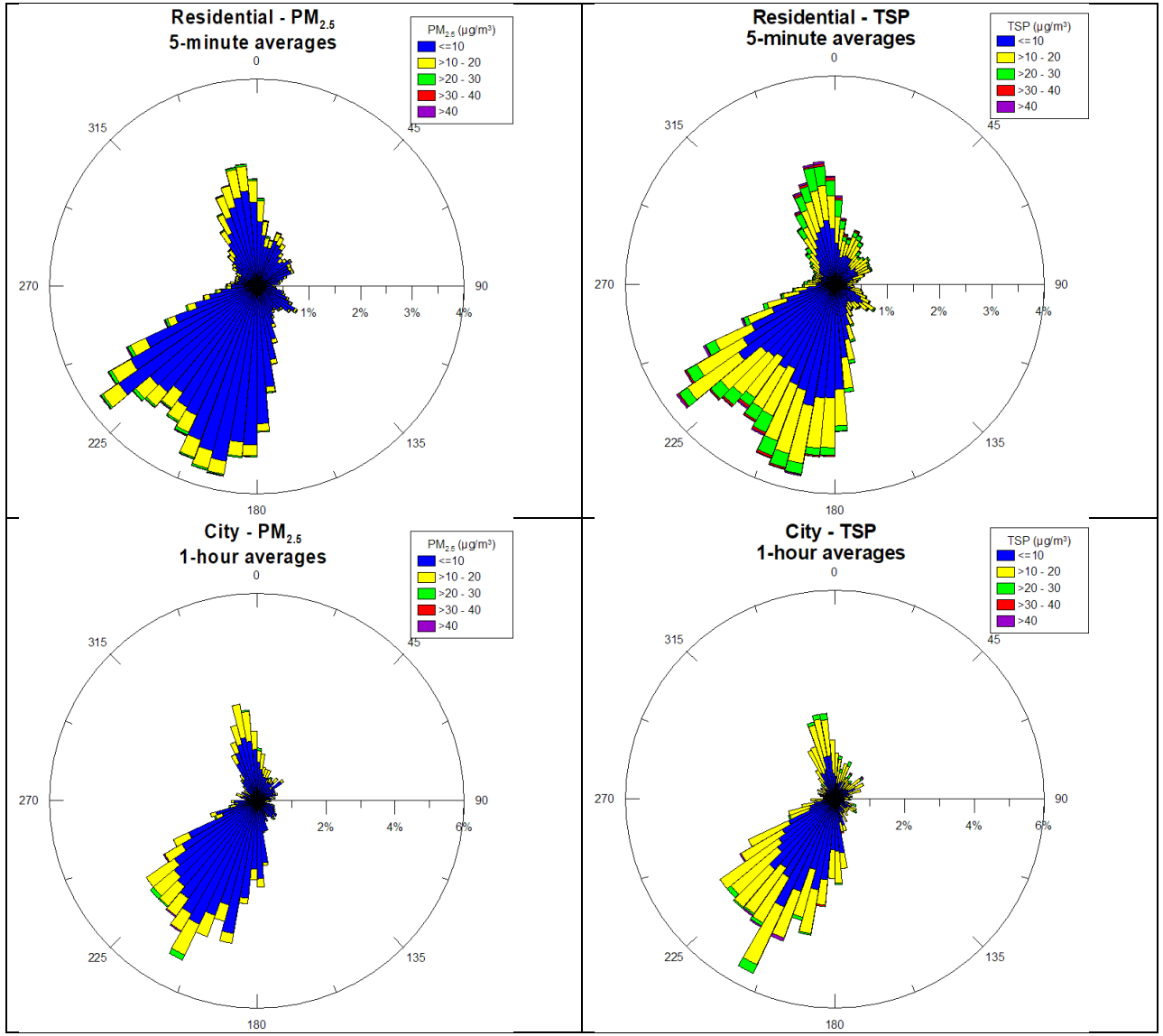


Figure 9. 24-hr average $PM_{2.5}$ concentrations for the study period


City - PM2.5
5-minute averages
PM2.5 (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
0
45
90
135
180
225
270
315
1%
2%
3%
4%
City - TSP
5-minute averages
TSP (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
Heiser - PM2.5
5-minute averages
Heiser - TSP
5-minute averages


Residential - PM2.5
5-minute averages
PM2.5 (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
0
45
90
135
180
225
270
315
1%
2%
3%
4%
Residential - TSP
5-minute averages
TSP (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
0
45
90
135
180
225
270
315
1%
2%
3%
4%
City - PM2.5
1-hour averages
PM2.5 (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
0
45
90
135
180
225
270
315
2%
4%
6%
City - TSP
1-hour averages
TSP (µg/m³)
<=10
>10 - 20
>20 - 30
>30 - 40
>40
0
45
90
135
180
225
270
315
2%
4%
6%

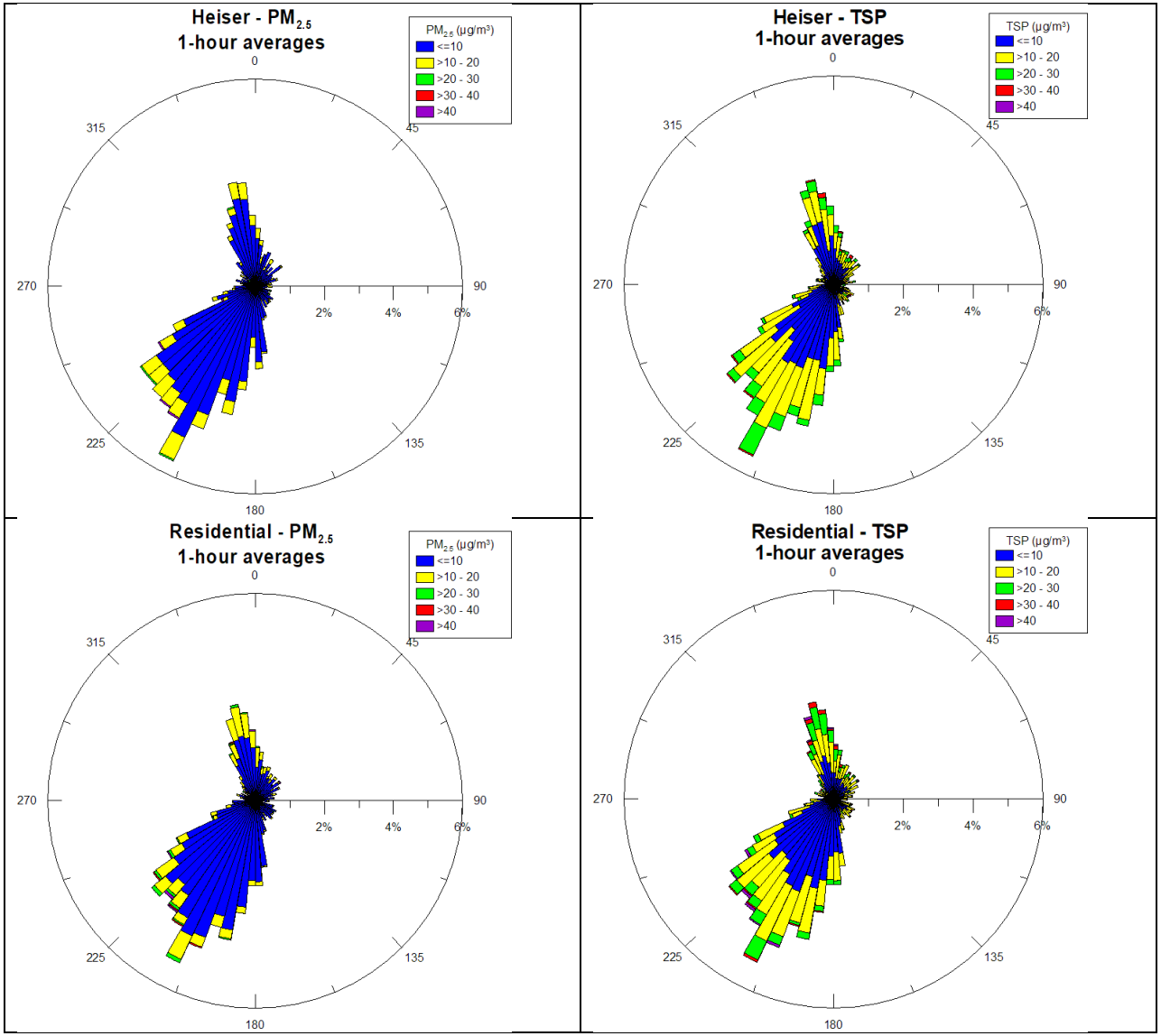


Figure 10. 5-min and 1-hour average TSP and $PM_{2.5}$ concentration roses for the study period

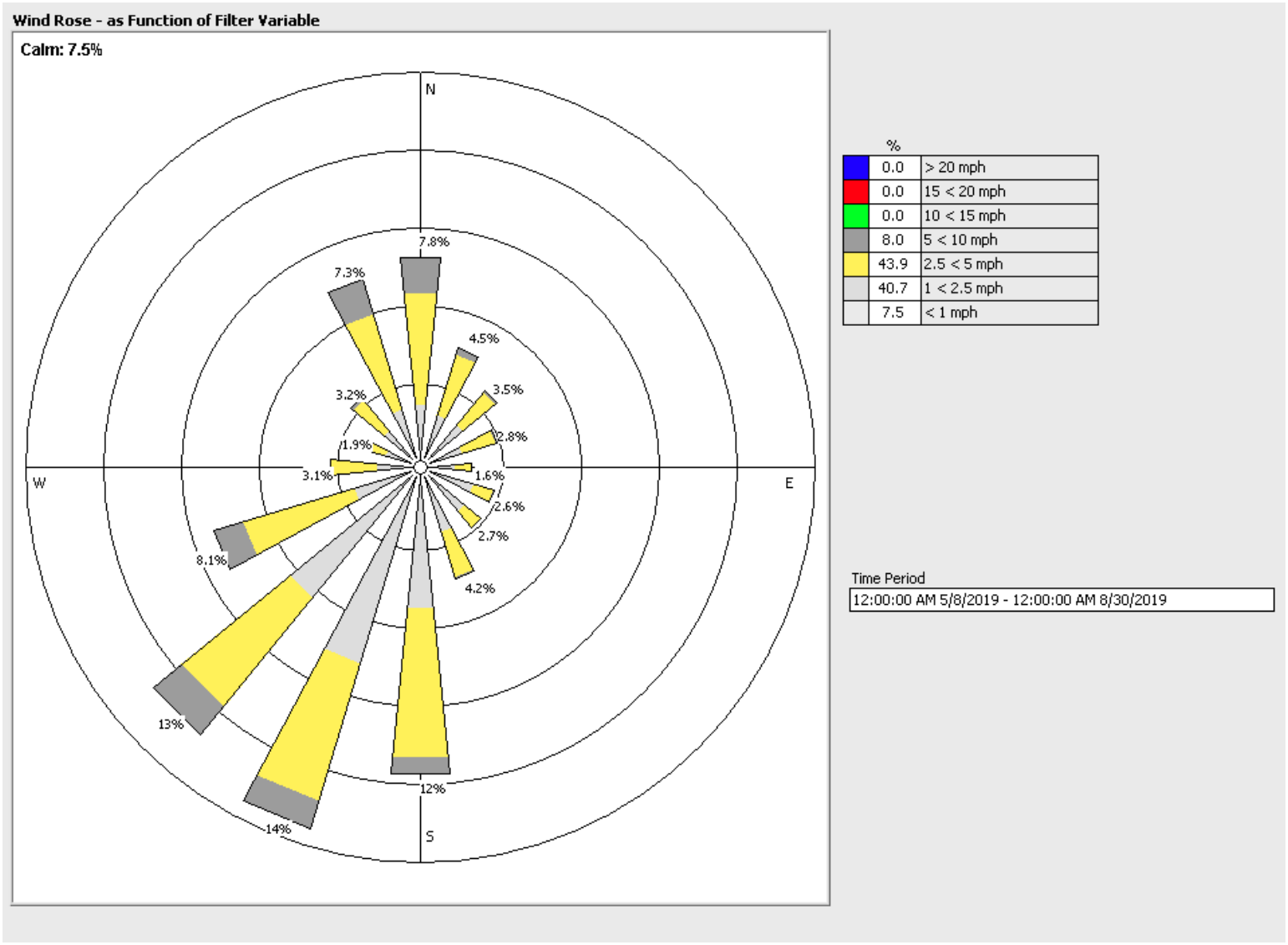


Figure 11. Heiser site wind rose for study period

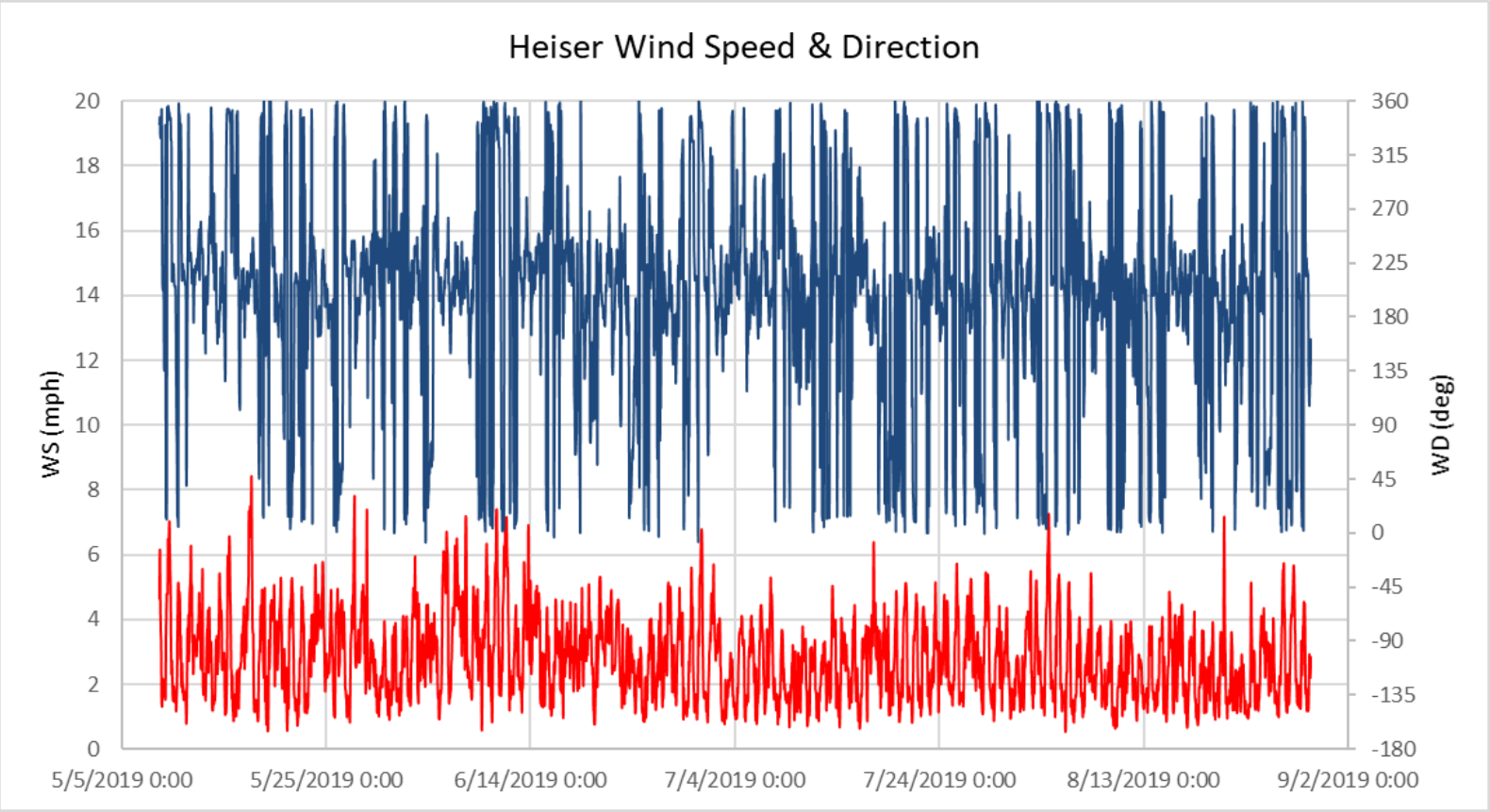


Figure 12. Heiser site wind speed (red) and direction (blue) for study period

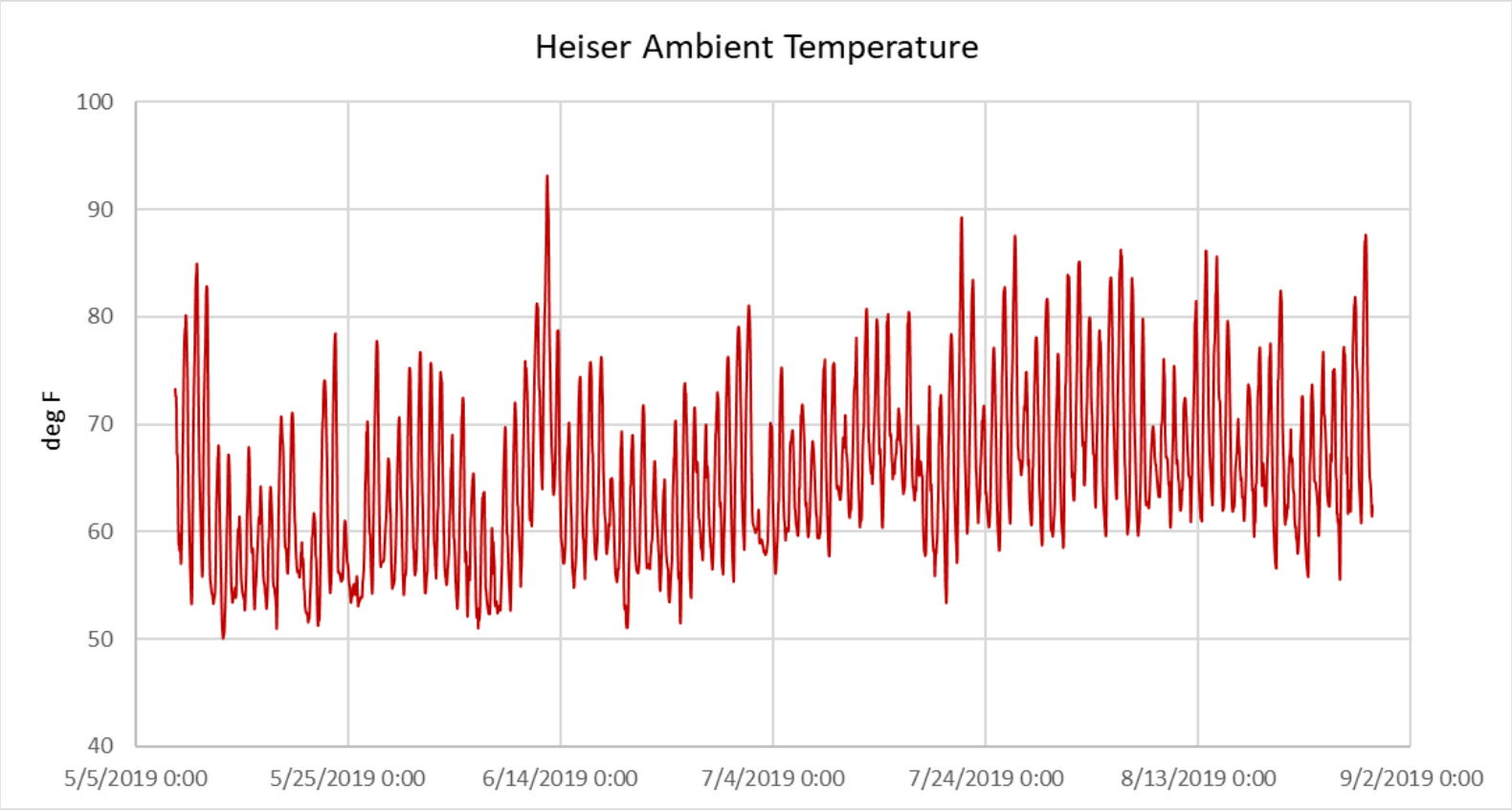


Figure 13. Heiser site ambient temperature for study period

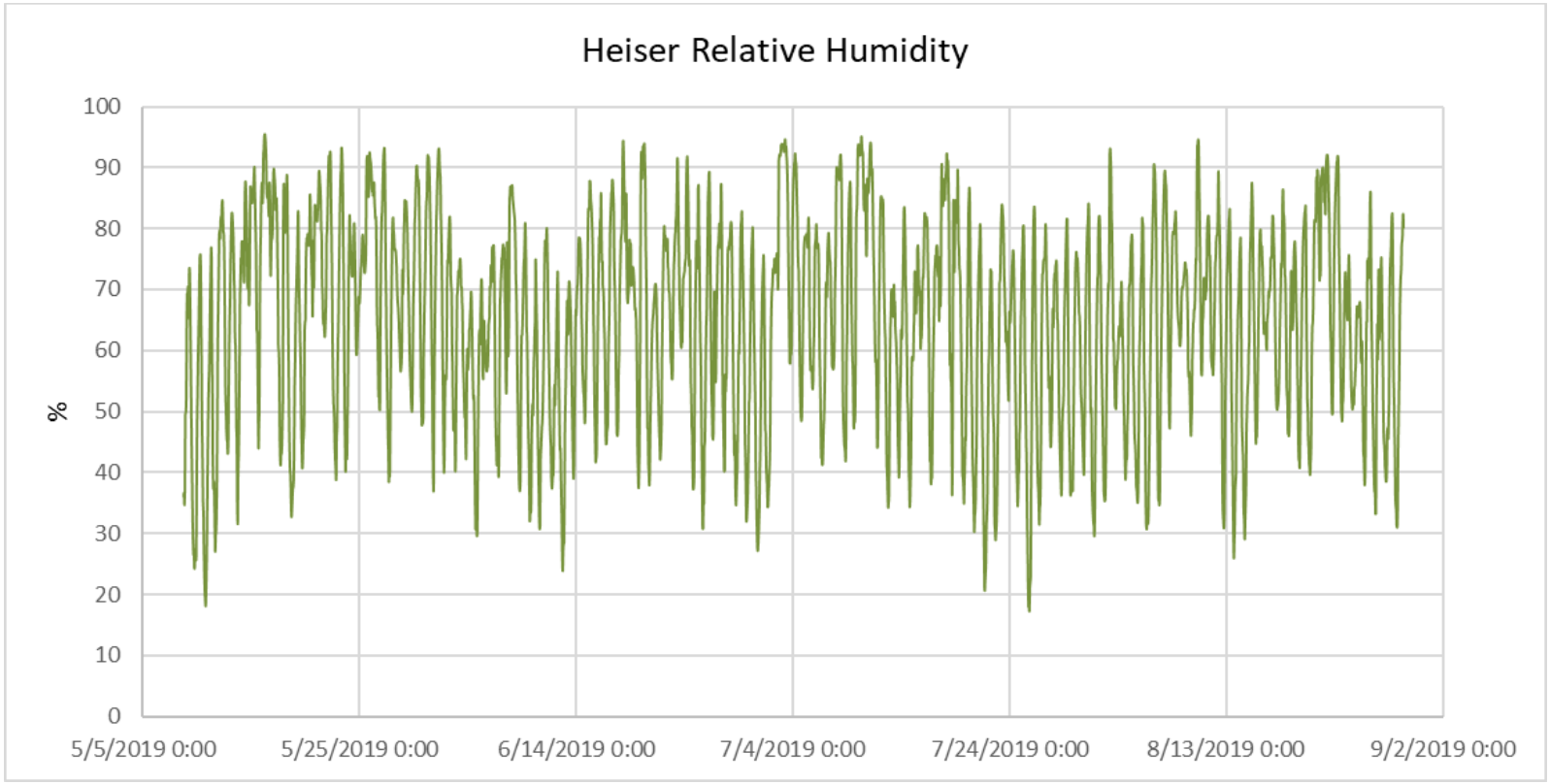


Figure 14. Heiser site relative humidity for study period

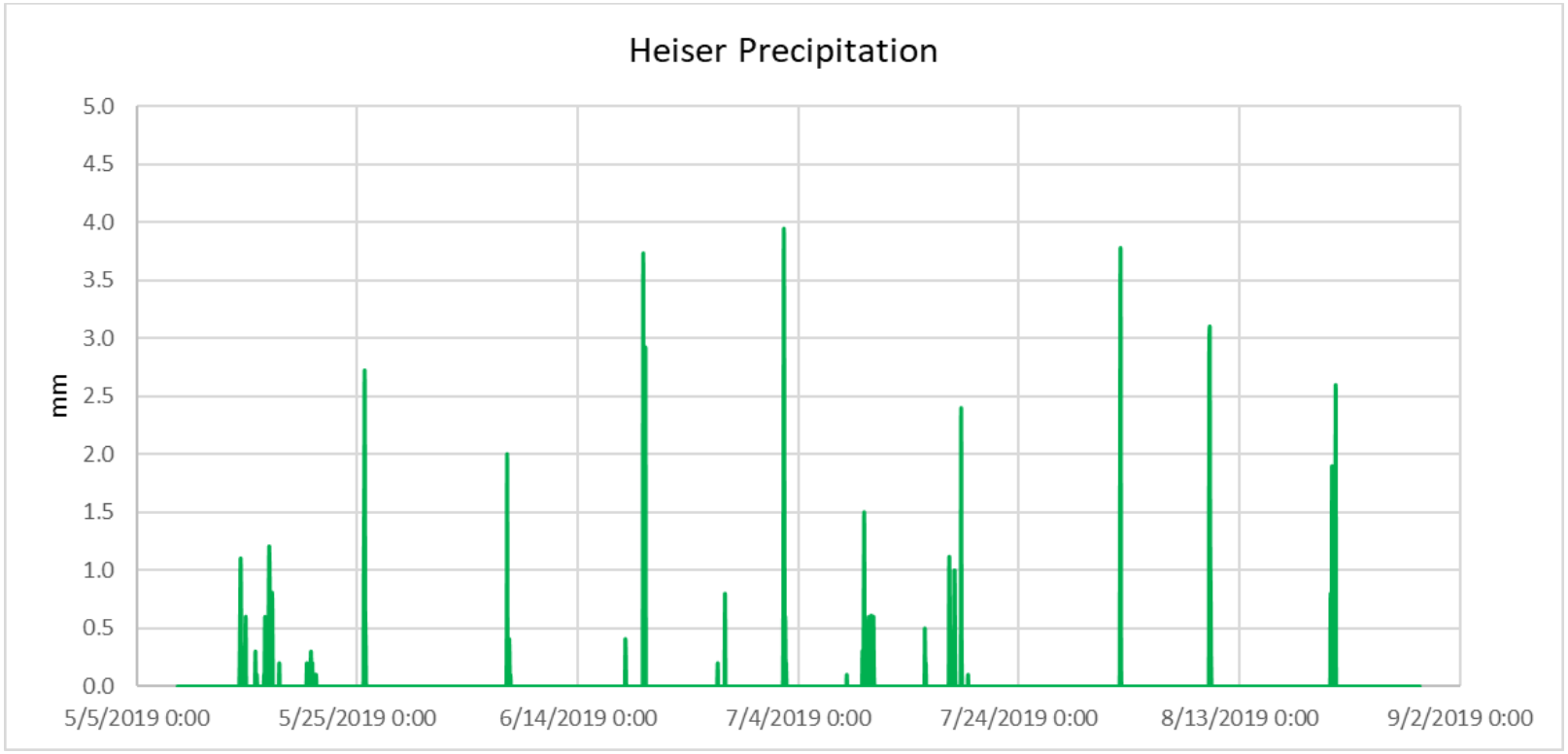


Figure 15. Heiser site precipitation for study period

Site Logs

Site CITY

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	5/9 11:00	5/15 1215	5/23 9:31	5/30 1149	6/5/19	6/14/19 1335	6/21/19
Samplers intact upon arrival (Y/N)	—	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	N	N	N	N	N	N	N
TSP flow rate (± 0.05 lpm)	2.0	2.0	2.0	2.0	2.0	1.7	1.6
PM2.5 flow rate (± 0.05 lpm)	1.5	1.5	1.55	1.5	1.5	1.5	1.5
TSP zero check (≤ 2 ug/m3)	0	0.0-1.9	0.0-~~1.9~~ 0.3	0.0-2.1	?	5.7	~~6.0~~ 5.8
PM2.5 zero check (≤ 2 ug/m3)	0	0.0	0.0	0.0	?	0.0	0.0
Samplers operating (Y/N)	Y	~~Unk~~ Y	Y	Y	Y	Y	Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y
		1227 offsite CW	09:55 ~~offsite~~ /kg	1159 CW offsite	09:51 OFFSITE /kg		

Comments:

5-9-19: INSTALLED SITE

5/15/19 PM2.5 Showed 0.0 ug/m³ upon arrival; Flow observed at 1.5 lpm; Discussed w/ D. Yoho and all systems appear operational TSP is low and $PM_{2.5}$ appears to correlate w/ ~~low~~ TSP.

5/23/19 TSP Flow @ 1.7 LPM. NOT READING. CALLED D. YOHO AND adjusted flow rate on meter to 2.3 LPM; Flow reads 2.0 LPM after calibration. RECORDED. NEW ZERO Reading 0.0-0.3 ug/m3. All $PM_{2.5}$ readings as expected. D. YOHO- "WATCH TSP FLOW TO ENSURE PUMP NOT DEGRADING."

5/30/19 all systems operational

6/5/19 systems operational but could not get site access to open box and read O's when filter put on. Site access typically only available Thursday/Friday. ESJ to coordinate w/City special site access on Monday to set up PCB monitoring equip.

Site City

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	6/24/19 16:10	6/28/19 16:20	7/5/19 1220	7/11/19 09:40	7/19/19 9:40	7/25/19 1237	7/27/19 0910
Samplers intact upon arrival (Y/N)	YES	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	No	N	N	N	N	N	N
TSP flow rate (± 0.05 lpm)	1.75	1.7 → 1.95	2.0	2.0	2.0	1.7 → 2.0	1.8 → see note
PM2.5 flow rate (± 0.05 lpm)	1.5	1.5	1.5	1.5	1.5	1.5	1.5
TSP zero check (≤ 2 ug/m3)	0.0	0.0	0.0	1.3-2.8	0.3-2.5	4.6 → 0.0-2.0	0.0
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0	0.0	See note	0.0	See note	0.0
Samplers operating (Y/N)	Y	Y	Y	Y	Y	Y	Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y
		OFFSITE 16:44		OFFSITE 1000	OFFSITE 10:10	OFFSITE 1335	

Comments:

7/11/19 $PM_{2.5}$ sampler read 00 with no noise for 5 min despite starting new run + full power reboot does not pick up AM from crumpling tissue. Flow rate is normal. called D. Yotto he advises we should order new pump and will coordinate that. E.Jones to set up an operational TSP pump working w/no issues

7/19/19 $PM_{2.5}$ sampler reading 0.0 entire time of visit. Assumed to be operational, just no $PM_{2.5}$ to read (same as last visit on 7/11)

7/25/19 $PM_{2.5}$ sampler screen reading in 200-400 mg/m^3 range and reporting on data logger as 1000 $\mu g/m^3$. Flatlined @ 1000 over last several days. Cycled power on $PM_{2.5}$, data logger power, took out unit batteries, and re-zeroed. Readings still too high. Contacted D. Bush & D. Yotto to have new pump sent. Rezeroed TSP and recalibrated flow rate.

7/27/19 TSP flow rate low. Called D. Yotto to discuss, agreed best to keep flow rate as is w/pump flow rate at 2.8 and readings on rotometer at 1.8 so as not to max pump. TSP reading 0.0 $\mu g/m^3$ but does register generated particulate OK. Replaced $PM_{2.5}$ pDR and both flow and zero checks in expected range after initial calibration

Site City

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	8/1/19 1218	8/8/19 1055	8/15/19 1530	8/22/19 1130			
Samplers intact upon arrival (Y/N)	Y	Y	Y	Y			
Samplers filter changed (Y/N)	N	N	See Note	N			
Sample Flow rate (lpm)							
TSP flow rate (± 0.05 lpm)	1.7	1.6	1.5	1.6			
PM2.5 flow rate (± 0.05 lpm)	1.5	1.5	1.5	1.5			
Zero Check (ug/m3)							
TSP zero check (≤ 2 ug/m3)	0.1	See note	1.2	1.7			
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0	0.0	0.0			
Samplers operating (Y/N)	Y	TSP: No ; PM2.5: Yes	TSP replaced; Y	Yes			
Site secured (Y/N)	Y	Y	Y	Y			

Comments:

8/1/19 Low TSP flow consistent w/ previous site check on 7/27/19; TSP readings on pDR appear to be w/in previously observed range

8/8/19 TSP Screen reads Conc: nan ug/m3 TWA: 20.46 mg/m3 ; restarted @ 1250 after cycling power upon restart TSP reading ~65 ug/m3 TWA: 65.93 mg/m3 ; Call to D. Yoho at T&B Systems for next steps and left a message; Unable to zero unit

8/15/19 TSP ug 8/15 ~~PM2.5~~ Filter changed when new TSP sampler replaced. Old filter left in old pDR until laboratory-provided filter container/jar is available - TSP filter will need to be analyzed for metals. Sample removed 8/15/19 15:35 Both samplers operational/working after replacing TSP pDR.

GATE CODE 3018

Site Heisea

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	6/25/19 15:15	6/28/19 9:08	7/5/19 1100	7/11/19 [illegible]	7/19/19 08:15	7/25/19 11:50	8/1/19 1137
Samplers intact upon arrival (Y/N)	Y	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	N	N	N	N	Y	N	N
TSP flow rate (± 0.05 lpm)	1.85→2.0	1.9→2.0	2.05	2.0	2.0	2.0	1.9→2.0
PM2.5 flow rate (± 0.05 lpm)	1.45	1.5	1.45	1.4→1.5	1.3→1.5	1.3→1.5	1.5
TSP zero check (≤ 2 ug/m3)	0.0-1.3	0.0-2.0	0.0	0.0	0.0	0.0	0.0
PM2.5 zero check (≤ 2 ug/m3)	0.0-2.1	0.0-1.1	0.0-8.0	0.0	22.0→0.0	0.0	0.0
Samplers operating (Y/N)	Y	Y	N-See Note	Y	Y	Y	Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y

Comments:

6/25/19 : TSP Flow rate low, recalibrated from 1.85 LPM to 2.0 LPM
$PM_{2.5}$ Flow rate low, recalibrated from 1.85 LPM to 1.45 LPM

6/28/19 : TSP Flow rate low, recalibrated from 1.9 LPM to 2.0 LPM

7/5/19: TSP Sampler off upon arrival. Turned back on at 1100

7/11/19 · $PM_{2.5}$ Flow low, recalibrated from 1.4 → 1.5 LPM

7/19/19: TSP sampler off on arrival, turned on @ 8:15. $PM_{2.5}$ Not zeroing even after changing filter. Replaced TSP PDR per D. Botts direction. New PDR zeros. Both systems on & operational @ 9:05 upon leaving.

7/25/19 · **$PM_{2.5}$ Samplers flatlined**, cycled power to pumps. Checked all connections. Cycled power on $PM_{2.5}$. Afterwards, readings in normal range and zero check OK. TSP operating w/no issues

8/1/19 PM 2.5 sampler appeared to flatline; Cycled power to pumps. After restart, PM2.5 readings in normal range and zero check ok

Site HEISER

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	5/8 13:00	1133 5/15	8:51 5/23	5/30 1210	6/4 8 55	6/14/19 13:05	6/21/19 1117
Samplers intact upon arrival (Y/N)	Y	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	N	N	N	N	N	N	N
TSP flow rate (± 0.05 lpm)	2.0	2.0	2.0	2.0	2.0	2.0	1.95
PM2.5 flow rate (± 0.05 lpm)	1.5	1.5	1.5	1.5	1.5	1.5	1.45
TSP zero check (≤ 2 ug/m3)	0.0	2.4-4.7	0.0	0.0	0.0	0.0	0.0
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0 - 1.4	0.0	0.0	0.0	0.0	0.0
Samplers operating (Y/N)	Y	Y	Y	Y	Y	Y	TSP-N PM-Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y
		1150 offsite CW	9:20 OFFSITE SMJ	1015 CW offsite	9:05 OFFSITE/cmj		

Comments:

5/8/19 = INSTALLED SITE

6/14/19 - Arrived on site and observed dust generation associated with street cleaning with blowers to clean pavement for parking striping

6/21/19 TSP was off upon arrival. TSP monitor restored to operation at ~1115

Heiser has begun operation at facility and begun storing trucks in lot

Site Heiser

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	8/9/19 1216	8/15/19 1500	8/23/19 1155				
Samplers intact upon arrival (Y/N)	Y	Y	Y				
Samplers filter changed (Y/N)	N	N	N				
Sample flow rate (lpm)	-	-	-	-	-	-	-
TSP flow rate (± 0.05 lpm)	2.0	2.0	2.0				
PM2.5 flow rate (± 0.05 lpm)	1.5	1.5	1.5				
Zero check reading (ug/m3)	-	-	-	-	-	-	-
TSP zero check (≤ 2 ug/m3)	0.0	0.9	0.0				
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0	0.0				
Samplers operating (Y/N)	Y	Y	See Note				
Site secured (Y/N)	Y	Y	Y				

Comments:

8/8/19 - All Systems operational

8/15/19 – Adjusted TSP Flow Rate from 1.9 LPM → 2.0 LPM
Rebooted $PM_{2.5}$ because readings were flatlined prior to arrival. Conc. Readings normal & zero ok after reboot

8/23/19 - Rebooted PM2.5 because readings were flatlined upon arrival. Conc. Readings normal + zero after reboot

Site RESIDENTIAL

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	5/8 14:00	5/15 12:00	5/23 10:03	5/30 1130	6/5/19 9-13	6/14/19 1125	6/21/19 1200
Samplers intact upon arrival (Y/N)	Y	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	N	N	N	N	N	N	N
TSP flow rate (± 0.05 lpm)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PM2.5 flow rate (± 0.05 lpm)	1.5	1.4	1.5	1.5	1.5	1.5	1.5
TSP zero check (≤ 2 ug/m3)	0.0	0.0-2.3	1.0-2.6	1.0-3.1	0.0-1.4	0.0-1.3	0.1-1.6
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0-1.2	0.0-1.1	0.0-1.1	0.0-2.3	0.0-1.3	0.4-1.1
Samplers operating (Y/N)	Y	Y	Y	Y	Y	Y	Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y
		1208 OFFSite CW			9:30 OFFSITE/jaj		

Comments:

5/8/19 = INSTALLED SITE

5/23/19 FLOW ON TSP GOOD BUT $PM_{2.5}$ FLOW LOW. INCREASED PUMP RATE TO 1.7 LPM, NEW FLOW READING @ 1.5 LPM. TSP NOT ZEROING, BOUNCING BETWEEN 1.0-2.6 WITH MOST READINGS 2.1-2.6 ug/m3. $PM_{2.5}$ ZERO OK, MOST READINGS @ NEAR 0.0 ug/m3

5/30/19 All systems operational

6/14/19 All systems operational

Site Residential

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	6/25/19 15:58		7/5/19 1145	7/11/19 0900	7/19/19 0910	7/25/19 1340	8/1/19 1250
Samplers intact upon arrival (Y/N)	Y	Y	Y	Y	Y	Y	Y
Samplers filter changed (Y/N)	N	N	N	N		N	N
TSP flow rate (± 0.05 lpm)	1.9	2.0	2.0	2.0	2.0	2.0	2.0
PM2.5 flow rate (± 0.05 lpm)	1.45	1.55	1.5		1.7 → 1.5	1.5	1.5
TSP zero check (≤ 2 ug/m3)	0.4 - 3.1	0.0 - 4.0	0.9 - 2.5	0.1 - 2.7	~~0.2 → 0~~ 1.2-3.7	4.0 → 0.0	0.6 - 1.2
PM2.5 zero check (≤ 2 ug/m3)	0.0 - 3.1	0.8 - 3.0	0.0	0.3 - 1.5	0.2 - 0.6	4.0 → 0.0	0.0
Samplers operating (Y/N)	Y	Y	Y	Y	Y	Y	Y
Site secured (Y/N)	Y	Y	Y	Y	Y	Y	Y

Comments:

7/11/19 both TSP & $PM_{2.5}$ working as normal/expected

7/19/19: TSP working as normal/expected. $PM_{2.5}$ higher zero/conc than TSP, checked and reduced flow rate. Then rezeroed machine per Dytho because conc still higher than TSP. New zero readings 0.2 - 0.6 ug/m3

7/25/19: Spider webs in both TSP and $PM_{2.5}$ inlet. Neither fully zero. Call D yoho and rezero/recalibrate both.

8/1/19: Both systems operational

Site Residential

pDR-1500 Checklist - Seattle Iron & Metals

TSP: Black Cyclone
PM2.5 : Blue Cyclone

Date/Time:	8/8/19 1334	8/15/19 1620	8/23/19				
Samplers intact upon arrival (Y/N)	Y	Y	Y				
Samplers filter changed (Y/N)	N	N	✓				
TSP flow rate (± 0.05 lpm)	2.0	2.0	2.0				
PM2.5 flow rate (± 0.05 lpm)	1.5	1.45	1.45				
TSP zero check (≤ 2 ug/m3)	~~47-5.5~~ 0.0	0.9	0.9				
PM2.5 zero check (≤ 2 ug/m3)	0.0	0.0	0.0				
Samplers operating (Y/N)	Y	Y	Y				
Site secured (Y/N)	Y	Y	Y				

Comments:

8/8/19: TSP will not zero at ≤ 2 ug/m³; Re-zero'd unit @ 1400 BKG:OK; Restart run @ 1404

FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
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Calculation
Meeting Notes
Phone Call Notes
Memorandum

Date: 6/10/19
Project No.: Sim-Storm

Created by: Emily Jones
Reviewed by:

Subject: Set-up PCB/Dioxin PUF Samplers

Sim Dust Study Site Visit 6/10/19

E. Jones Arrived @ Heiser Site @ 2:15
David Yoho Arrives @ 2:20
All Systems intact & operational

WANT Flow reading on new PCB/dioxin sampling pump to be ~11LPM during entire period
Document start & stop dates & times for all samples – won't be able to see readings on 2/3 of the new pump systems
CAN ADJUST FLOW w/screwdriver on front face of pump if flow drops when return to collect sample
Silver surface = correct low flow filter – don't use blue

Take flow readings from Qa row. Qa won't measure flow <1 LPM.

Materials:
zip ties
electrical tape
new filter
new sampling form
Qa flow conder
old sample jar

Will need to attach and reattach POLY tubing from cone
FILTER inserts into poly tubing via wide poly tubing connection
Tape poly tubing to cone and reattach to stand w/zip ties
Wrap filter in tin foil when collecting sample & place back in sample jar to ship
Write site name on label of glass container & collection date/time
Pack on gel pack in insulated shippers & ship to lab
Collect flow sample reading after taking off filter from poly tube exterior to box.
Heiser sample started 14:52

Each visit make sure pump inlet tubing still intact

→ Calibrate flow if needed
Then record new flow for start of next sample
insert new filter
reattach to post

3:01 secure site & depart @ 3:05

E. Jones & David Yoho arrive to residential site @ 3:15
Property owner notes their family had a bonfires in the last week, will check calendar & send dates/approx timeframe to E. Jones
D. Yoho Begins setting up equipment. PUF sampler flow meter will be in the box with power supply.
Difficult to calibrate flow @ residential site – pump is different than at other 2 sites. This pump DOES allow a total flow reading.

Pump power connection a bit loose so ensure SITTING ON CORD = GOOD FIT

SAMPLE START @ 15:43 PUMP FLOW RATE 1.02 LPM

To turn ON/OFF — call david — but can do it by hitting up + down at same time
needs to be "off hold" to be running.
To cycle through Readings use * button — flow on pump = 900ml → 1.02 LPM on reader

15:48 site secured & offsite @ 15:50

E. JONES & DAVID YOHO ARRIVE @ CITY TRANSFER STATION @ 4:00 /16:00
MEET JEFF NEUNER FOR ACCESS
ALL SYSTEMS OPERATIONAL & INTACT

PUMP FLOW @ 1.07 LPM SAMPLE START @ 16:00

SECURE SITE @ 16:12 DEPART @ 16:15

EJ

SIM PUF Sampling

Site	PUF Filter ID	Start Date/Time	Start Flowrate	End Date/Time	End Flowrate	Total Volume	Sampler period - minutes
Residential	25764408	7/13/19 1336	1.1 LPM	7/19/19 0931	1.1 LPM		0000/8937
Heiser	25984648	7/19/19 0826	1.1 LPM	7/25/19 1209	1.1 LPM		0000/8833
Residential	25984656	7/19/19 0940	1.1 LPM	7/25/19 1330	1.0 LPM		0000/8895
City	25984649	7/19/19 1003	1.0 LPM	7/25/19 1316	1.0 LPM		0000/8838
Heiser	25984657	7/25/19 1222	1.1 LPM	8/1/19 1145	~~1.0 LPM~~ 1.0L PM CW upon restart		0000/Sample Over
CITY	25984650	7/25/19 1325	1.0 LPM	8/1/19 1037	1.0 LPM upon restart		0000/Sample Over
Residential CW 26014139	~~25984658~~	7/25/19 1400	1.1 LPM	8/1/19 1250	1.0 LPM upon restart		0000/Sample Over
Heiser	26106653	8/1/19 1156	1.0 LPM	8/8/19 1226	1.0 LPM upon Restart		0000/Sample Over
City	26106652	8/1/19 1234	1.0 LPM	8/8/19 1252	1.0 LPM upon restart		0000/Sample Over
Residential	26106654	8/1/19 1317	1.0 LPM	8/8/19 1334	1.0 LPM upon restart		0000/Sample Over
Heiser	26183343	8/8/19 1230	1.0 LPM	8/15/19 1508	1.0 LPM upon Restarter		0000/Sample Over
City	26106655	8/8/19 1309	1.0 LPM	8/15/19 1555	1.0 LPM upon Reset		0000/SAMPLE over
Residential	26106650	8/8/19 1350	1.0 LPM	8/15/19 1623	1.0 LPM upon Reset		0000/SAMPLE over
Heiser	26183342	8/15/19 15:23	1.0 LPM	8/23/19 1155	1.0 LPM upon Reset		0000/Sample Over
CITY	26183341	8/15/19 16:04	1.0 LPM	8/23/19 1130	0.9 LPM Upon Restart		0000/Sample Over
Residential	26183344	8/15/19 16:30	1.0 LPM	8/23/19 1105	1.0 LPM upon Restart		0000/Sample Over

Comments:

7/13/19 Residential — started new sample w/pump connected to AC power rather than battery on 7/13/19.

7/19/19 Heiser — snapped neck of glass tube on removal of sample from tubing.
City — SCREEN READ "SAMPLE OVER" AND PUMP OFF WHEN I ARRIVED
Residential - no issues

7/25/19 Heiser — no issues
City — no issues.
Residential — **no issues.**

8/1/19 Heiser - Screen read "Sample over" and pump off upon arrival; Flow 1.0 LPM upon restart
City - " " " " " " " " " " " " Same condition as Heiser
Residential - " " " " " " " " " " " " Same Condition as Heiser

8/8/19 Heiser "Sample Over" + pump off; Sampler runs for 9999 minutes approx Sample end time ~ 1030
City "Sample Over" - Pump off; Sampler runs for 9999 minutes approx sample end time ~ 1100
Residential "Sample Over" + Pump off; Sampler runs for 9999 minutes approx Sample end time ~ 1130

8/15/19 Heiser "SAMPLE OVER" + PUMP OFF; " " " Approx sample end time ~ 1130
CITY "SAMPLE OVER" + PUMP OFF; " " " 1200
Residential "SAMPLE OVER" + PUMP OFF; " " " ~ 12:30

8/23/19 Residential " " " " " ~1500 8/22
City " " " " " ~1430 8/22

SIM PUF Sampling

Site	~~PUF Filter ID #~~	Start Date/Time	Start Flowrate	End Date/Time	End Flowrate	Total Volume	START / END
Heiser		6/10/19 14:52	1.098 LPM	6/14/19 ~~1530~~	(2) 1.00	—	
Residential		6/10/19 15:43	1.02 LPM	6/14/19 1170	(1)		
City		6/10/19 16:00	1.07 LPM	6/14/19 1346	(3) 1.00	—	
~~Heiser~~		~~6/24/19~~	~~1.09 LPM~~	~~6/24/19~~ 6/24/19			25% on screen
City	25745104	6/24/19 16:20	1.085 LPM	6/28/19 16:23	0 LPM		1531 pt Start / 0000
Heiser	25745102	6/25/19 15:30	1.055 LPM	6/28/19 9:13	1.05 LPM		0000 / ?
Residential	25745105	6/25/19 16:10	1.08 LPM	6/28/19 17:07	0 LPM		0000 / 3643
Heiser	25745103	6/28/19 9:31	1.05 LPM	7/5/19 1107	1 LPM		0000 / 0238
City 25745101	~~25745103~~ CW 7/5/19	6/28/19 16:37	1.1 LPM	7/5/19 1225	1 LPM		0000 / 9829
Residential	25745100	6/28/19 17:20	1.15 LPM	7/5/19 1150	0 LPM		0000 / 0204
Heiser	25764410	7/5/19 1119	1.00 LPM	7/11/19 0833	1.1 LPM		0000 / ~~9824~~ 1531
Residential	25764409	7/5/19 1200	1.00 LPM	7/11/19 0928	0 LPM		0000 / 1155
City 25764407	~~25764~~ CW 7/5/19	7/5/19 1237	1.00 LPM	7/11/19 0954	1.0 LPM		0000 / 8481
Heiser	25764405	7/11/19 0845	1.1 LPM	7/19/19 0825	1.1 LPM		0000 / ~~458~~ 5536
Residential		~~7/11/19~~	NO SAMPLE SEE NOTES				
City	25764406	7/11/19 0459	1.0 LPM	7/19/19 ~~0900~~ 0940	0 LPM		0000 / sample over

Comments:

6/14/19 - Residential - Qa: Under ; Vol - 486.0 L , 27.6°C , INS: 29.73 , min 554 , Flow: 900 mL/min

① System appears to inadvertantly been powered off and was not sampling when I arrived on site. Called D. Yoho to discuss sampler off, powered unit down until new filter can be received.

② Heiser meter placed on hold due to no filter after sample collection; Challenger calibrator read Qa: Under (external rotameter ~1.0 → internal rotameter ~1.0)

③ City Meter placed on hold due to no filter after sample collection; " " " " "

6/28/19 [CITY] - PUMP WAS NOT RUNNING WHEN I ARRIVED. SCREEN READ 0000 SAMPLE OVER. PREVIOUS SAMPLE ON 6/24/19 READ 1530 AT START. STARTED NEW SAMPLE WITH SCREEN READING AT 0000 AND FLOW AT ~1.1 LPM.

[RESIDENTIAL] - PUMP WAS NOT RUNNING WHEN I ARRIVED. SCREEN READ "3643 HOLD" AND "LO BATT". PRESSED START BUTTON AND SCREEN TICKED MINUTES UP READ "SAMPLE RUNNING" AND "BATT" WITH FLOW AT 1.2. MAY HAVE BEEN BUMPED OFF DURING WEEK. STARTED NEW SAMPLE WITH TIME AT 0000 AND FLOW AT 1.25 LPM

[HEISER] NO APPARANT ISSUES WITH SAMPLE RUNNING OR SAMPLE COLLECTION. DID NOT READ # OF MINUTES OFF PUMP

7/5/19 Heiser - No Apparent issues - Sample Running

Residential - Does not appear to be running upon arrival. Hold, LoBatt, 0204 displayed; Removed filter and tested flow - Rotameter = Ø pressed Start and Pump turned on Rotameter = 1

Turned on/off Battery Check OK

City - No apparent issues - Sampler Running

Heiser 7/11/19 - Yesterday during power check sample time was 0401; today pulled sample @ 1531. Assumed affected by 7/9/19 power out

Residential: Battery issue not resolved, still says LO BATT / HOLD, pump not running. No AC Adapter to replace battery. Per David's recommendation will remove pump and bring to office to resolve w/SKC.

Metals Analysis Results

Location	Lab ID	Analyte	Metals Mass (micrograms)	Metals Concentration (micrograms/m^3)
City	18-T125	Copper	3.3	0.037
		Lead	1.0	0.011
		Mercury	0.025	0.00028
		Zinc	3.3	0.037
Heiser	18-T123	Copper	2.3	0.033
		Lead	0.85	0.012
		Mercury	0.025	0.00036
		Zinc	6.3	0.092
Residential	18-T124	Copper	3.2	0.047
		Lead	2.1	0.031
		Mercury	0.0086	0.00013
		Zinc	15.5	0.23

T&B SYSTEMS
PROJECT: SMS

CLIENT # T011
REPORT # 19-438

SUBMITTED BY:
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Case Narrative

Date: September 12, 2019

General Information

Client:	T&B Systems
Client Number:	T011
Report Number:	19-438
Sample Description:	37mm Teflon
Sample Numbers:	18-T123 – 18-T125

Analysis

Analytes:	XRF Metals (Na – Pb)
Analytical Protocols:	X-Ray Fluorescence: EPA IO-3.3 (June 1999 version)
Analytical Notes:	No problems were encountered during the analyses. The results have not been blank corrected.
QA/QC Review:	All of the data have been reviewed by the analysts performing the analyses and the project manager. All of the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.
Comments:	If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.
Disclaimer:	This report shall not be reproduced, except in full, without the written approval of the laboratory. The results only represent that of the samples as received into the laboratory.

Paul Duda 9/12/19

Project Manager Date
Paul Duda

Client: T011 - T&B Systems
Report Number: 19-438

Lab ID: 18-T123
Filter Lot #: T71415
Deposit Area: 6.60 cm²

Analyte	pg/filter			percent		
Gravimetry						
Net Mass	2,329.	±	10.			
XRF						
Na	55.29	±	10.73	2.374	±	0.4609
Mg	25.76	±	3.260	1.106	±	0.1400
Al	51.59	±	5.103	2.215	±	0.2193
Si	146.4	±	12.53	6.285	±	0.5388
P	3.432	±	0.2891	0.1474	±	0.0124
S	106.3	±	8.012	4.562	±	0.3446
Cl	8.672	±	0.5425	0.3724	±	0.0233
K	24.85	±	1.412	1.067	±	0.0608
Ca	64.10	±	3.544	2.752	±	0.1526
Ti	5.343	±	0.2680	0.2294	±	0.0115
V	0.3551	±	0.0238	0.0152	±	0.0010
Cr	0.4244	±	0.0251	0.0182	±	0.0011
Mn	1.579	±	0.0805	0.0678	±	0.0035
Fe	81.44	±	4.072	3.497	±	0.1755
* Co	0.0000	±	0.1056	0.0000	±	0.0045
Ni	0.2660	±	0.0139	0.0114	±	0.0006
Cu	2.336	±	0.1168	0.1003	±	0.0050
Zn	6.265	±	0.3135	0.2690	±	0.0135
* Ga	0.0000	±	0.0040	0.0000	±	0.0002
* Ge	0.0000	±	0.0033	0.0000	±	0.0001
As	0.2020	±	0.0145	0.0087	±	0.0006
Se	0.2086	±	0.0106	0.0090	±	0.0005
Br	0.5702	±	0.0290	0.0245	±	0.0013
Rb	0.0568	±	0.0053	0.0024	±	0.0002
Sr	0.5636	±	0.0284	0.0242	±	0.0012
Y	0.0224	±	0.0073	0.0010	±	0.0003
Zr	0.7570	±	0.0389	0.0325	±	0.0017
Mo	0.1439	±	0.0172	0.0062	±	0.0007
* Pd	0.0000	±	0.0185	0.0000	±	0.0008
* Ag	0.0323	±	0.0185	0.0014	±	0.0008
* Cd	0.0000	±	0.0191	0.0000	±	0.0008
* In	0.0000	±	0.0211	0.0000	±	0.0009
Sn	2.496	±	0.1274	0.1072	±	0.0055
Sb	0.3927	±	0.0449	0.0169	±	0.0019
Ba	3.114	±	0.2105	0.1337	±	0.0091
* La	0.0000	±	0.0535	0.0000	±	0.0023
Hg	0.0251	±	0.0079	0.0011	±	0.0003
Pb	0.8527	±	0.0442	0.0366	±	0.0019

* - XRF Concentration is less than three times the uncertainty

Client: T011 - T&B Systems
Report Number: 19-438

Lab ID: 18-T124
Filter Lot #: T71415
Deposit Area: 6.60 cm²

Analyte	µg/filter			percent		
Gravimetry						
Net Mass	3,299.	±	10.			
XRF						
* Na	47.23	±	15.87	1.432	±	0.4812
Mg	32.89	±	6.186	0.9969	±	0.1875
Al	80.19	±	10.74	2.431	±	0.3258
Si	224.0	±	24.63	6.790	±	0.7469
P	4.277	±	0.4541	0.1296	±	0.0138
S	118.3	±	10.84	3.587	±	0.3287
Cl	36.00	±	2.492	1.091	±	0.0756
K	37.01	±	2.257	1.122	±	0.0685
Ca	184.7	±	10.84	5.600	±	0.3289
Ti	7.359	±	0.3689	0.2231	±	0.0112
V	0.5095	±	0.0317	0.0154	±	0.0010
Cr	0.9722	±	0.0515	0.0295	±	0.0016
Mn	3.701	±	0.1861	0.1122	±	0.0057
Fe	194.5	±	9.722	5.896	±	0.2952
* Co	0.0000	±	0.2468	0.0000	±	0.0075
Ni	0.4884	±	0.0251	0.0148	±	0.0008
Cu	3.233	±	0.1617	0.0980	±	0.0049
Zn	15.52	±	0.7755	0.4703	±	0.0236
Ga	0.0587	±	0.0059	0.0018	±	0.0002
* Ge	0.0000	±	0.0046	0.0000	±	0.0001
As	0.3234	±	0.0224	0.0098	±	0.0007
Se	0.3227	±	0.0165	0.0098	±	0.0005
Br	0.6211	±	0.0317	0.0188	±	0.0010
Rb	0.1003	±	0.0066	0.0030	±	0.0002
Sr	1.153	±	0.0581	0.0350	±	0.0018
Y	0.0409	±	0.0079	0.0012	±	0.0002
Zr	0.6699	±	0.0350	0.0203	±	0.0011
Mo	0.2033	±	0.0191	0.0062	±	0.0006
* Pd	0.0515	±	0.0191	0.0016	±	0.0006
* Ag	0.0000	±	0.0185	0.0000	±	0.0006
* Cd	0.0000	±	0.0191	0.0000	±	0.0006
* In	0.0000	±	0.0211	0.0000	±	0.0006
Sn	4.470	±	0.2251	0.1355	±	0.0068
Sb	0.2792	±	0.0442	0.0085	±	0.0013
Ba	2.632	±	0.2158	0.0798	±	0.0065
* La	0.0000	±	0.0673	0.0000	±	0.0020
* Hg	0.0086	±	0.0099	0.0003	±	0.0003
Pb	2.112	±	0.1069	0.0640	±	0.0032

* - XRF Concentration is less than three times the uncertainty

Client: T011 - T&B Systems
Report Number: 19-438

Lab ID: 18-T125
Filter Lot #: T71415
Deposit Area: 6.60 cm²

Analyte	µg/filter			percent		
Gravimetry						
Net Mass	1,573.	±	10.			
XRF						
Na	47.61	±	6.404	3.027	±	0.4076
Mg	18.86	±	1.843	1.199	±	0.1174
Al	29.55	±	2.403	1.879	±	0.1532
Si	63.69	±	4.621	4.049	±	0.2949
P	2.112	±	0.1558	0.1343	±	0.0099
S	106.1	±	6.956	6.743	±	0.4443
Cl	2.485	±	0.1538	0.1580	±	0.0098
K	22.29	±	1.216	1.417	±	0.0779
Ca	49.00	±	2.624	3.115	±	0.1680
Ti	2.963	±	0.1492	0.1884	±	0.0096
V	0.2983	±	0.0191	0.0190	±	0.0012
Cr	0.4151	±	0.0231	0.0264	±	0.0015
Mn	0.9834	±	0.0508	0.0625	±	0.0033
Fe	39.21	±	1.960	2.493	±	0.1256
* Co	0.0000	±	0.0528	0.0000	±	0.0034
Ni	0.2963	±	0.0152	0.0188	±	0.0010
Cu	3.395	±	0.1696	0.2158	±	0.0109
Zn	3.289	±	0.1643	0.2091	±	0.0105
Ga	0.0271	±	0.0040	0.0017	±	0.0003
* Ge	0.0000	±	0.0033	0.0000	±	0.0002
As	0.1478	±	0.0139	0.0094	±	0.0009
Se	0.1525	±	0.0079	0.0097	±	0.0005
Br	0.5544	±	0.0284	0.0352	±	0.0018
Rb	0.0403	±	0.0046	0.0026	±	0.0003
Sr	0.6052	±	0.0304	0.0385	±	0.0019
Y	0.0462	±	0.0073	0.0029	±	0.0005
Zr	0.3934	±	0.0218	0.0250	±	0.0014
Mo	0.1102	±	0.0165	0.0070	±	0.0010
* Pd	0.0000	±	0.0185	0.0000	±	0.0012
* Ag	0.0099	±	0.0185	0.0006	±	0.0012
* Cd	0.0323	±	0.0191	0.0021	±	0.0012
* In	0.0000	±	0.0211	0.0000	±	0.0013
Sn	2.219	±	0.1135	0.1411	±	0.0073
Sb	0.2462	±	0.0363	0.0157	±	0.0023
Ba	2.062	±	0.1478	0.1311	±	0.0094
* La	0.0000	±	0.0396	0.0000	±	0.0025
Hg	0.0251	±	0.0079	0.0016	±	0.0005
Pb	1.020	±	0.0521	0.0649	±	0.0033

* = XRF Concentration is less than three times the uncertainty

CHESTER LabNet

Quant'X 1020 **XRF Analytical Quality Assurance Report**

Client: T&B Systems
Report: 19-438
Analysis Period: September 11, 2019
Number of Samples: 3

1. Precision Data

Micromatter Multi-elemental Quality Control Standard: 34103

QC Standard Results

Analyte	n	micrograms per square centimeter			c.v.	%E
		Calib.	Meas.	S.D.		
Si	1	7.43	7.24	na	na	-2.59
Ti	1	10.50	10.37	na	na	-1.20
Fe	1	10.90	10.79	na	na	-0.98
Se	1	5.08	5.03	na	na	-0.99
Cd	1	6.49	6.63	na	na	2.10
Pb	1	12.38	12.20	na	na	-1.45

2. Accuracy Data

NIST Standard Reference Materials: SRM 2783

Analyte/ SRM	n	Certified Value(µg/cm²)	Measured Value (µg/cm²)			% Rec.
			High	Low	Average	
K 2783	4	0.5301	0.4577	0.4430	0.4488 +/- 0.0059	84.7
Ca 2783	4	1.3253	1.0658	1.0398	1.0578 +/- 0.0105	79.8
Ti 2783	4	0.1496	0.1290	0.1220	0.1264 +/- 0.0028	84.5
Fe 2783	4	2.6606	2.6075	2.5745	2.5853 +/- 0.0130	97.2
Cu 2783	4	0.0406	0.0383	0.0362	0.0375 +/- 0.0008	92.4
Zn 2783	4	0.1797	0.1730	0.1710	0.1720 +/- 0.0008	95.7
Pb 2783	4	0.0318	0.0382	0.0315	0.0338 +/- 0.0027	106.3

3. Addendum

Micromatter Certified Reference Materials

CRM	Analytes	Certified Value(µg/cm²)	Measured Value(µg/cm²)	% Rec.
39149	Cr	53.7	52.2	97.3
39150	Cu	49.4	51.1	103.4
39151	Zn, Te	49.9	52.0	104.1
39152	Ga, As	50.9	51.2	100.7
39153	Se, Cd	47.1	49.0	104.1
39154	Pb	47.9	48.8	102.0

NIST: National Institute of Standards and Technology
% Rec: Percent Recovery = (Experimental/Given) x 100
n: Number of Observations
S.D.: Standard Deviation
c.v.: Coefficient of Variation = (S.D./Measured) x 100
% E: Percent Error = [(Measured-Calibrated)/Calibrated] x 100

QUANT'X 1020 REPLICATE REPORT

4.45

Original ID: 18T124

Replicate ID: RT124

Element	Original ug/cm2		Replicate ug/cm2		Difference ug/cm2		RPD	
Na	7.1563	+- 2.4053	7.2967	+- 2.4465	-0.1403	+- 3.4308		
Mg	4.9830	+- 0.9372	4.6723	+- 0.8796	0.3107	+- 1.2853	+ 6.4	+- 26.6
Al	12.1452	+- 1.6283	11.8205	+- 1.5812	0.3247	+- 2.2697	+ 2.7	+- 18.9
Si	33.9350	+- 3.7323	33.6650	+- 3.6915	0.2700	+- 5.2495	+ 0.8	+- 15.5
P	0.6480	+- 0.0688	0.6720	+- 0.0711	-0.0240	+- 0.0990	+ -3.6	+- 15.0
S	17.9288	+- 1.6422	17.9895	+- 1.6434	-0.0607	+- 2.3233	+ -0.3	+- 12.9
Cl	5.4545	+- 0.3776	5.4115	+- 0.3742	0.0430	+- 0.5316	+ 0.8	+- 9.8
K	5.6070	+- 0.3420	5.6690	+- 0.3455	-0.0620	+- 0.4861	+ -1.1	+- 8.6
Ca	27.9915	+- 1.6415	27.7465	+- 1.6263	0.2450	+- 2.3107	+ 0.9	+- 8.3
Ti	1.1152	+- 0.0559	1.0932	+- 0.0548	0.0220	+- 0.0782	+ 2.0	+- 7.1
V	0.0772	+- 0.0048	0.0733	+- 0.0046	0.0039	+- 0.0066	+ 5.2	+- 8.8
Cr	0.1473	+- 0.0078	0.1403	+- 0.0075	0.0070	+- 0.0108	+ 4.9	+- 7.5
Mn	0.5608	+- 0.0282	0.5728	+- 0.0288	-0.0120	+- 0.0404	+ -2.1	+- 7.1
Fe	29.4688	+- 1.4734	29.4808	+- 1.4740	-0.0120	+- 2.0842	+ 0.0	+- 7.1
Co	0.0000	+- 0.0374	0.0000	+- 0.0374	0.0000	+- 0.0529		
Ni	0.0740	+- 0.0038	0.0726	+- 0.0037	0.0014	+- 0.0053	+ 1.9	+- 7.2
Cu	0.4898	+- 0.0245	0.4914	+- 0.0246	-0.0016	+- 0.0347	+ -0.3	+- 7.1
Zn	2.3505	+- 0.1175	2.3450	+- 0.1173	0.0055	+- 0.1660	+ 0.2	+- 7.1
Ga	0.0089	+- 0.0009	0.0077	+- 0.0008	0.0012	+- 0.0012	0 14.4	+- 14.3
Ge	0.0000	+- 0.0007	0.0000	+- 0.0007	0.0000	+- 0.0009		
As	0.0490	+- 0.0034	0.0537	+- 0.0036	-0.0047	+- 0.0049	+ -9.2	+- 9.6
Se	0.0489	+- 0.0025	0.0465	+- 0.0024	0.0024	+- 0.0034	+ 5.0	+- 7.2
Br	0.0941	+- 0.0048	0.0920	+- 0.0046	0.0021	+- 0.0066	+ 2.3	+- 7.1
Rb	0.0152	+- 0.0010	0.0173	+- 0.0011	-0.0021	+- 0.0015	0 -12.9	+- 9.2
Sr	0.1747	+- 0.0088	0.1764	+- 0.0089	-0.0017	+- 0.0125	+ -1.0	+- 7.1
Y	0.0063	+- 0.0012	0.0078	+- 0.0012	-0.0015	+- 0.0017	+ -21.4	+- 24.6
Zr	0.1015	+- 0.0053	0.1012	+- 0.0053	0.0003	+- 0.0075	+ 0.3	+- 7.4
Mo	0.0308	+- 0.0029	0.0297	+- 0.0029	0.0011	+- 0.0041	+ 3.6	+- 13.4
Pd	0.0079	+- 0.0029	0.0004	+- 0.0028	0.0075	+- 0.0040		
Ag	0.0000	+- 0.0028	0.0044	+- 0.0028	-0.0044	+- 0.0040		
Cd	0.0000	+- 0.0029	0.0090	+- 0.0029	-0.0090	+- 0.0041		
In	0.0000	+- 0.0032	0.0075	+- 0.0032	-0.0075	+- 0.0045		
Sn	0.6772	+- 0.0341	0.6372	+- 0.0323	0.0400	+- 0.0469	+ 6.1	+- 7.1
Sb	0.0423	+- 0.0067	0.0564	+- 0.0074	-0.0141	+- 0.0100	0 -28.6	+- 20.3
Ba	0.3988	+- 0.0327	0.4318	+- 0.0335	-0.0330	+- 0.0469	+ -7.9	+- 11.3
La	0.0000	+- 0.0102	0.0000	+- 0.0101	0.0000	+- 0.0143		
Hg	0.0013	+- 0.0015	0.0025	+- 0.0015	-0.0012	+- 0.0021		
Pb	0.3200	+- 0.0162	0.3088	+- 0.0156	0.0112	+- 0.0225	+ 3.6	+- 7.1

RPD: Relative Percent Difference (X1-X2)/[(X1+X2)/2]*100. RPD is calculated when original value is greater than three times its uncertainty.

PCB/Dioxin Analysis Results

Sample ID	Sample Date	Total PCBs Mass (picograms)	Total PCBs Concentration (picograms/liter)
CIT-061419	6/14/19	2800 J	0.51
CITY-06282019	6/28/19	890 J	0.15
CITY-20190711-0719	7/19/19	940 J	0.094
CITY-20190719-0725	7/25/19	1400 J	0.15
CITY-20190725-0801	8/1/19	1900 J	0.19
CITY-20190801-0808	8/8/19	1500 J	0.15
CITY-20190808-0815	8/15/19	1600 J	0.16
CITY-20190815-0823	8/23/19	1500 J	0.15
CITY-25745101	7/5/19	1600 J	0.16
CITY-45764407	7/11/19	1200 J	0.15

Sample ID	Sample Date	Dioxin/Furan TEQ Mass (picograms)	Dioxin/Furan TEQ Concentration (picograms/liter)
CIT-061419	6/14/19	0.83 J	0.00015
CITY-06282019	6/28/19	0.81 J	0.00014
CITY-20190711-0719	7/19/19	1.8 J	0.00018
CITY-20190719-0725	7/25/19	2.3 J	0.00026
CITY-20190725-0801	8/1/19	1.0 J	0.00010
CITY-20190801-0808	8/8/19	1.1 J	0.00011
CITY-20190808-0815	8/15/19	1.9 J	0.00019
CITY-20190815-0823	8/23/19	0.95 J	0.000095
CITY-25745101	7/5/19	0.89 J	0.000090
CITY-45764407	7/11/19	2.1 UJ	0.00024

Sample ID	Sample Date	Total PCBs Mass (picograms)	Total PCBs Concentration (picograms/liter)
HEI-061419	6/14/19	3100 J	0.55
HEISER-06282019	6/28/19	570 J	0.14
HEISER-20190711-0719	7/19/19	1100 J	0.13
HEISER-20190719-0725	7/25/19	1100 J	0.12
HEISER-20190725-0801	8/1/19	1200 J	0.12
HEISER-20190801-0808	8/8/19	2100 J	0.21
HEISER-20190808-0815	8/15/19	1900 J	0.19
HEISER-20190815-0823	8/23/19	1600 J	0.16
HEISER-25745103	7/5/19	1400 J	5.9
HEISER-25764410	7/11/19	950 J	0.62

Sample ID	Sample Date	Dioxin/Furan TEQ Mass (picograms)	Dioxin/Furan TEQ Concentration (picograms/liter)
HEI-061419	6/14/19	0.70 J	0.00012
HEISER-06282019	6/28/19	0.74 J	0.00019
HEISER-20190711-0719	7/19/19	1.4 J	0.00017
HEISER-20190719-0725	7/25/19	2.0 U	0.00023
HEISER-20190725-0801	8/1/19	1.7 U	0.00017
HEISER-20190801-0808	8/8/19	1.2 J	0.00012
HEISER-20190808-0815	8/15/19	1.7 U	0.00017
HEISER-20190815-0823	8/23/19	2.1 J	0.00021
HEISER-25745103	7/5/19	0.70 J	0.0029
HEISER-25764410	7/11/19	1.4 UJ	0.00093

Sample ID	Sample Date	Total PCBs Mass (picograms)	Total PCBs Concentration (picograms/liter)
RES-061419	6/14/19	1400 J	0.25
RES-25745100	7/5/19	470 J	2.3
RES-25764409	7/11/19	1100 J	0.91
RESIDENTIAL-06282019	6/28/19	980 J	0.27
RESIDENTIAL-20190713-0719	7/19/19	1000 J	0.12
RESIDENTIAL-20190719-0725	7/25/19	930 J	0.10
RESIDENTIAL-20190725-0801	8/1/19	950 J	0.095
RESIDENTIAL-20190801-0808	8/8/19	2100 J	0.21
RESIDENTIAL-20190808-0815	8/15/19	1900 J	0.19
RESIDENTIAL-20190815-0823	8/23/19	1600 J	0.16

Sample ID	Sample Date	Dioxin/Furan TEQ Mass (picograms)	Dioxin/Furan TEQ Concentration (picograms/liter)
RES-061419	6/14/19	0.64 J	0.00012
RES-25745100	7/5/19	0.75 J	0.0037
RES-25764409	7/11/19	2.0 UJ	0.0017
RESIDENTIAL-06282019	6/28/19	1.1 J	0.00030
RESIDENTIAL-20190713-0719	7/19/19	1.3 U	0.00014
RESIDENTIAL-20190719-0725	7/25/19	2.0 U	0.00023
RESIDENTIAL-20190725-0801	8/1/19	1.5 U	0.00015
RESIDENTIAL-20190801-0808	8/8/19	0.98 J	0.000098
RESIDENTIAL-20190808-0815	8/15/19	0.76 U	0.000076
RESIDENTIAL-20190815-0823	8/23/19	0.93 J	0.000093