Low-cost sensor-based PM$_{2.5}$ and VOC monitoring result in Northwood and Orchard Hills neighborhoods near All American Asphalt (AAA) in Irvine

Wednesday March 3 2021,

ALL AMERICAN ASPHALT COMMUNITY MEETING

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Jun Wu Research Group, UCI

Community air monitoring

- ***Objectives:***

- Monitor PM2.5 And VOC levels in neighborhoods surrounding AAA

- Identify hotspots of VOC in the community

- Investigate temporal and spatial variation of VOC and PM2.5 in the community

- ***Goals:***

- Providing spatio-temporal supplemental data to optimize reference measurement strategies

Monitoring campaign:

- **Duration:** Nov 1, 2020- Ongoing
- **Original Locations:**

2&4 Near school- Residential

5&6 Background- Residential

1&3 Near-source- Residential

- **Additional locations:**

7&8 Near-source- Residential

- **Pollutants:** $PM_{2.5}$ and TVOC
- **Instrumentation:** ATMOTUBE PRO
- **Meteorology:** Provided by SCAQMD
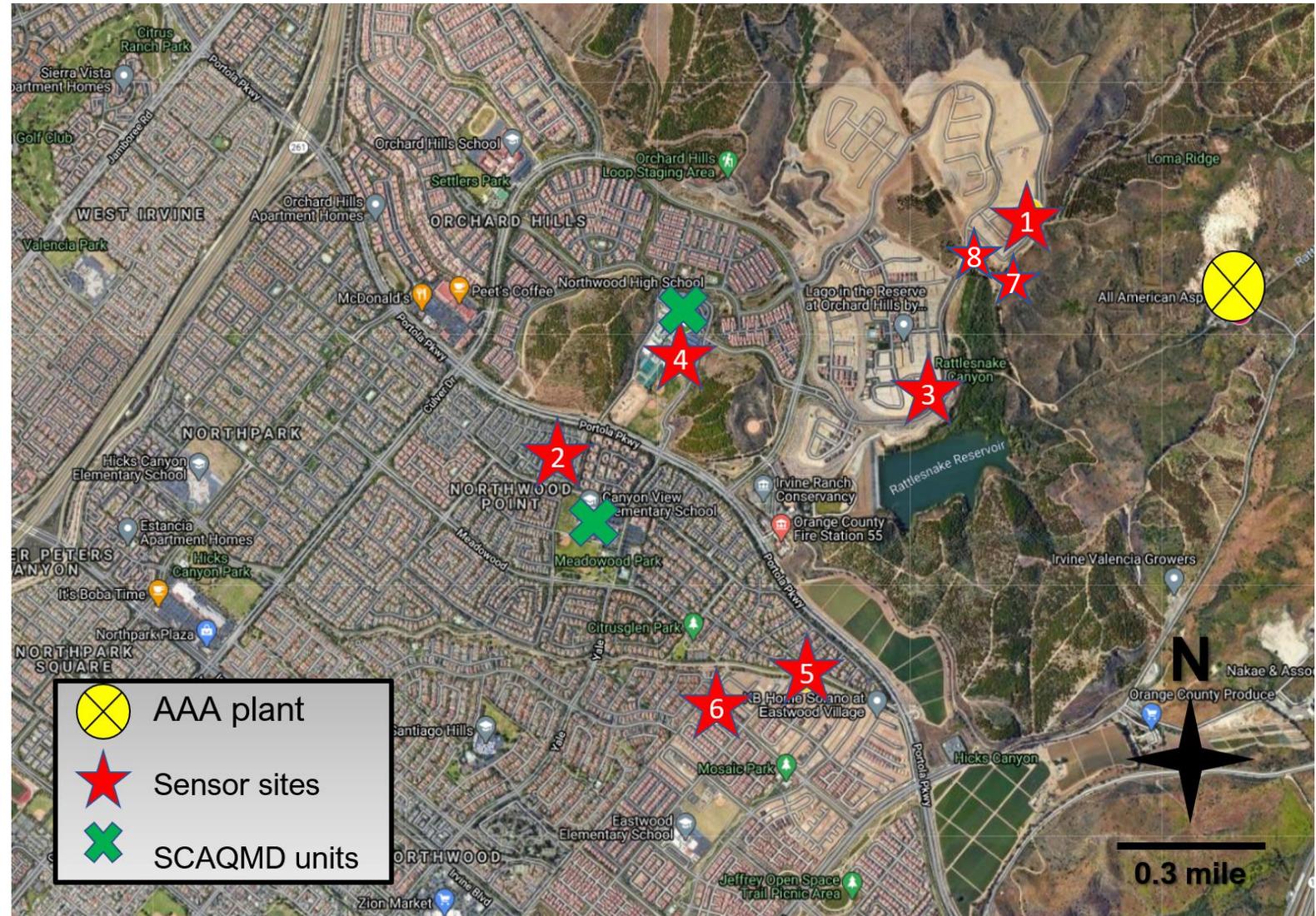
ATMOTUBE PRO portable sensor

www.Sensirion.com/SGPC3

- **$PM_{2.5}$:**

❏ Particle sensor: optical; non-FEM (model SPS30, Sensirion)

❏ AQ-SPEC (Field evaluation report)

- **TVOC:**

❏ MEMS / MOx-type VOC sensor (Sensirion SGPC3, digital)

❏ TVOC output range: 0 - 60 ppm, Typical accuracy: 15% of measured value, Measurement interval: 1 min

- **Factory Calibration:**

❏ ISO16000-29 Test Gases for VOC Detectors

❏ Using ethanol, serving as a stable, reliable and economical proxy for TVOC.

❏ Burn-in in a controllable environment for several hours for <u>100%</u> of manufactured devices and comparing the measurement results to the lab calibrated electrochemical sensor in an automatic mode

- **Limitation:**

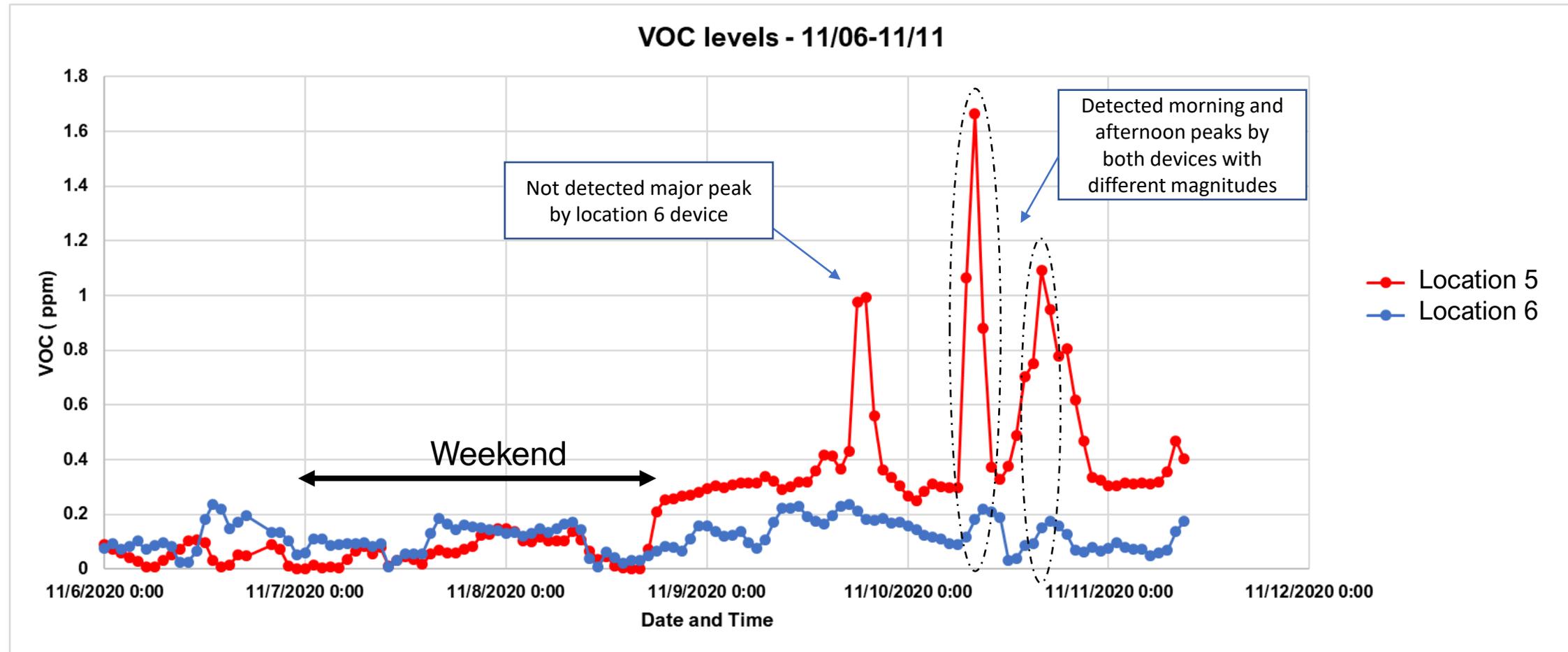❏ Not validated or compared with reference agency method data

- ***Strength:***

- Provides spatio-temporal trend VOC data to compare intra- sensor variability
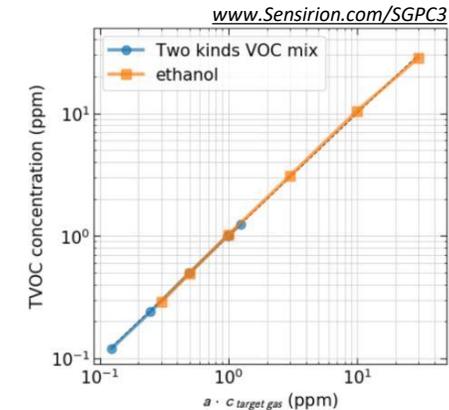
www.Sensirion.com/SGPC3

Pilot TVOC data

VOC levels - 11/06-11/11

Pilot PM$_{2.5}$ Data

PM2.5 levels - 11/06-11/11
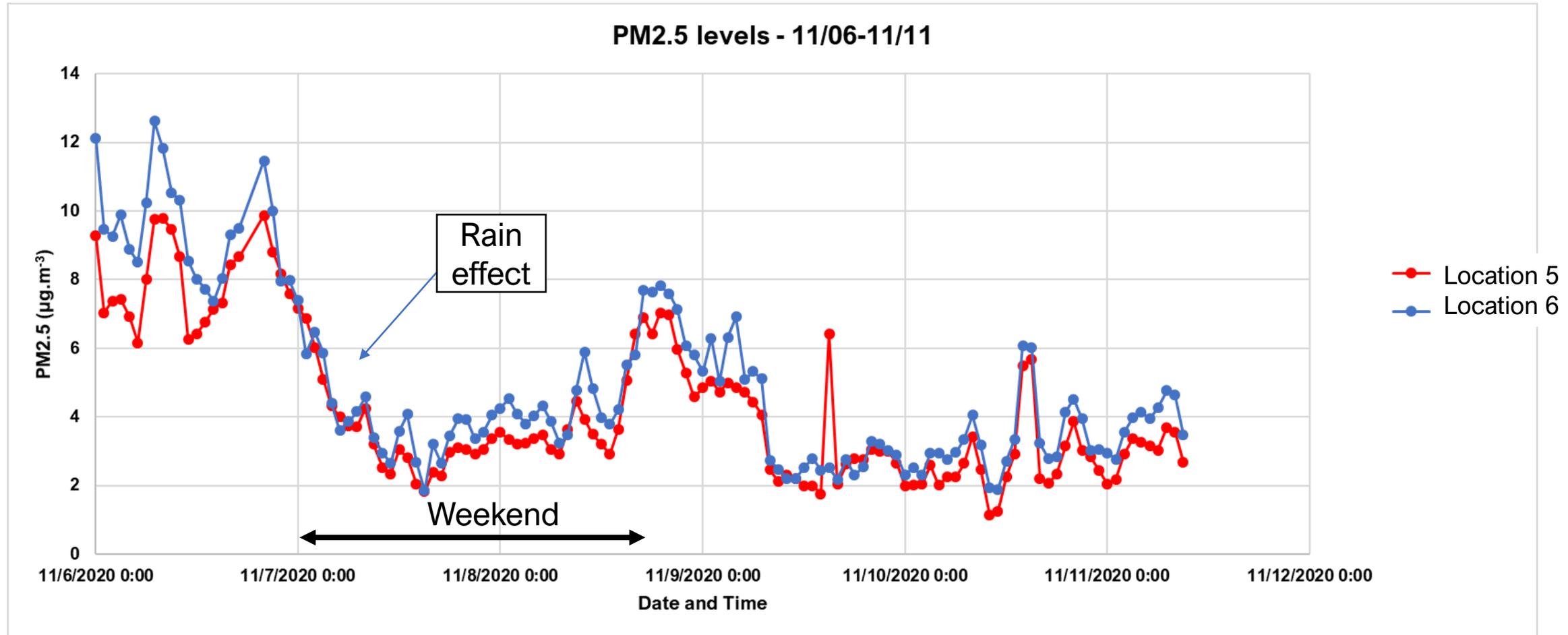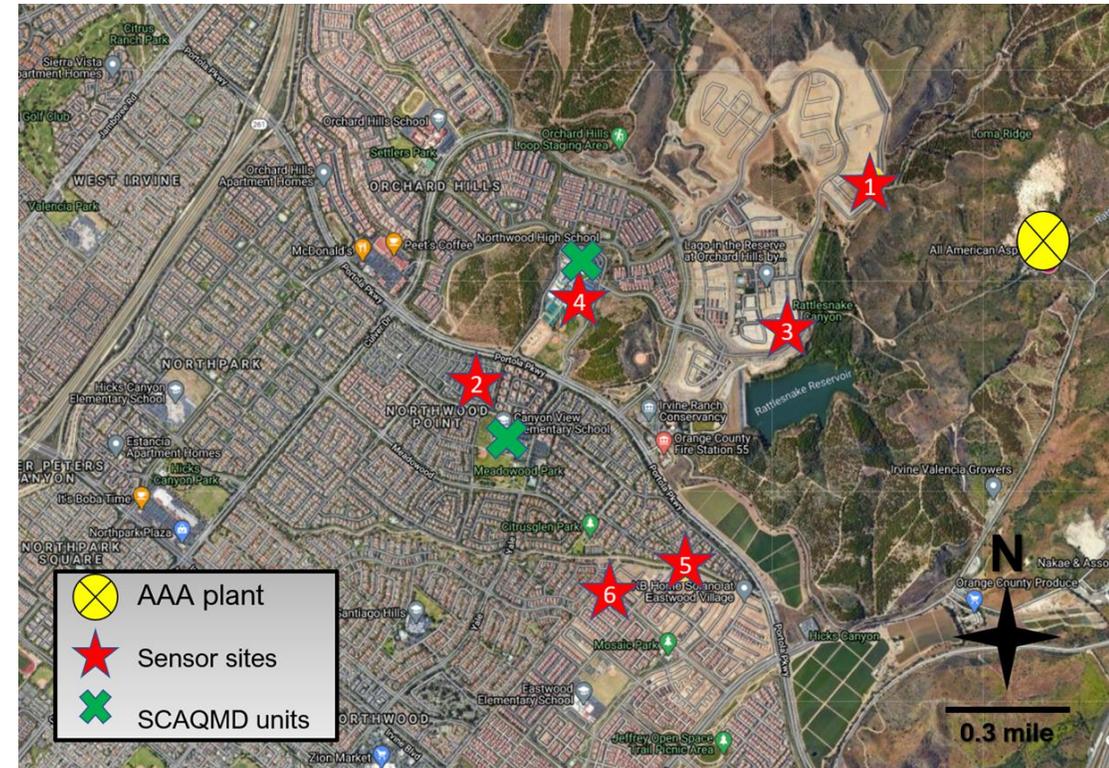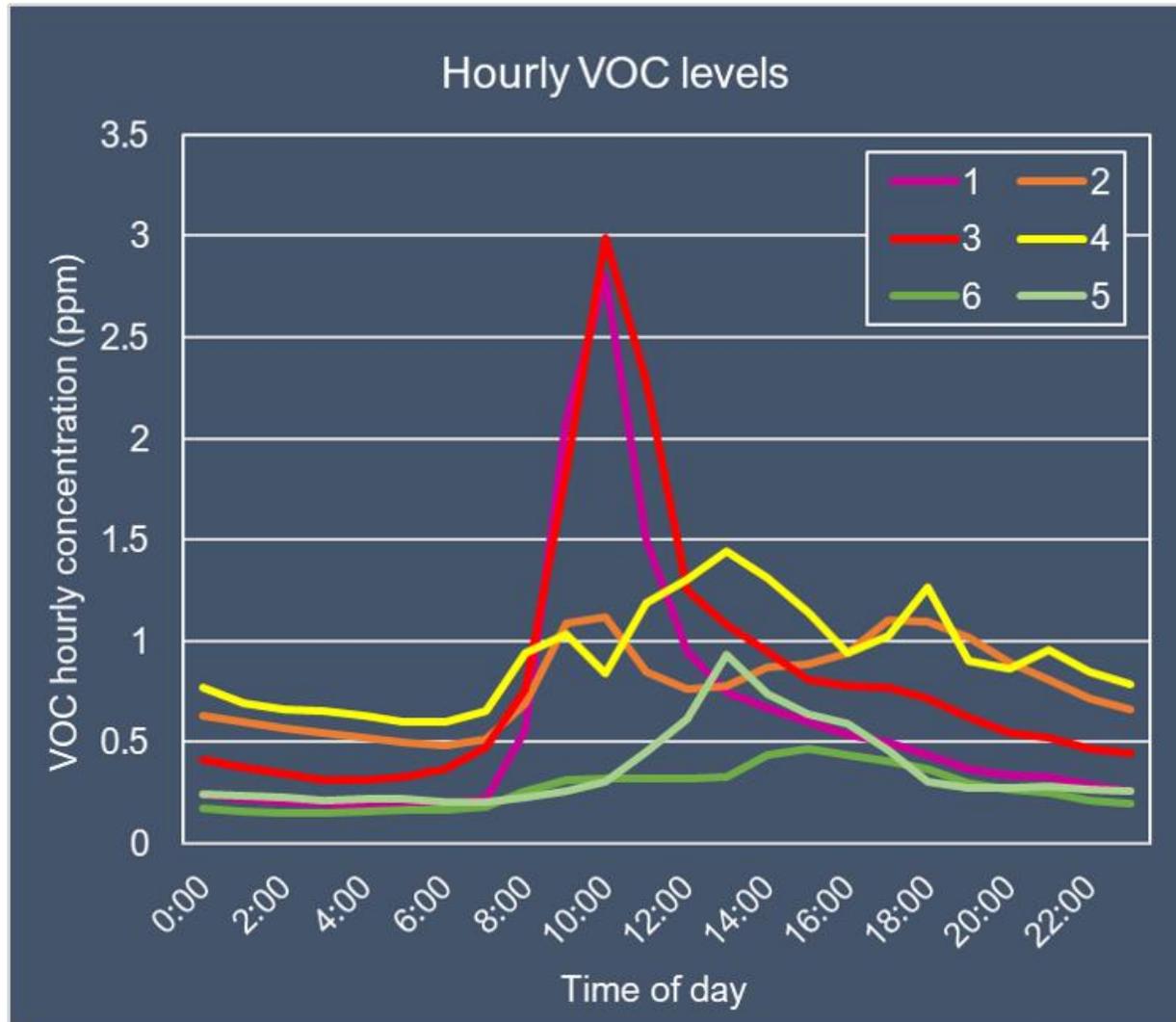
Hourly TVOC levels

Daily TVOC sensor-based levels

Daily average VOC sensor-based concentration (November 1, 2020- February 15, 2021)

Legend:
- (>2 ppm)
- (1- 2 ppm)
- (0.5-1 ppm)
- (0-0.5 ppm)

* Number of sampling days at each site

** VOC level classifications are based onrecommended levels based on previous measurments. There are no official stantard levels for VOC outdoor levels reported by local or regulatory agencies.
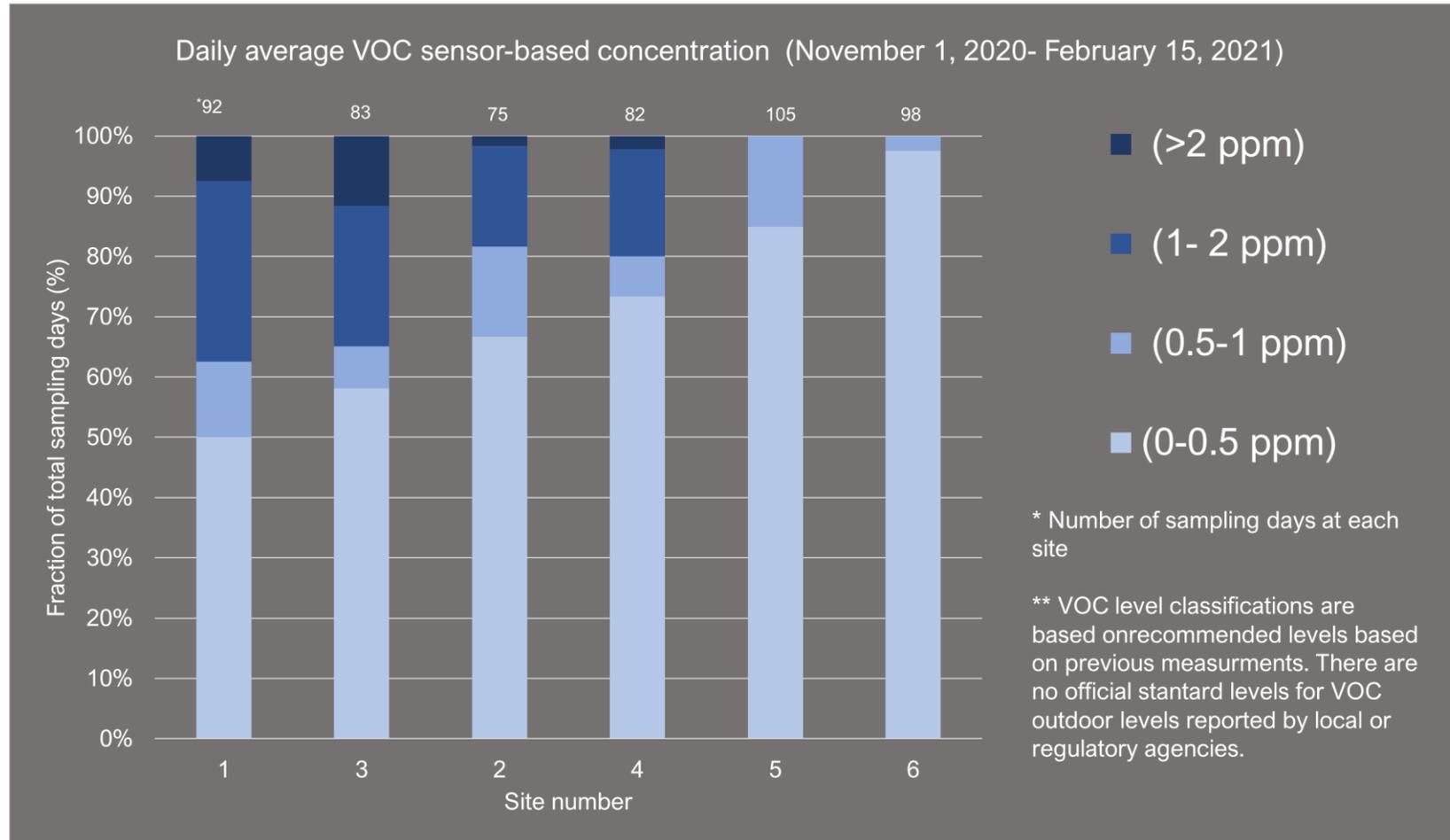
Daily variation in TVOC levels

- Dates in grey shows SCAQMD sampling dates in the community

Date	Location 1	Location 2	Location 3	Location 4	Location 5	Location6	Location 7	Location 8
28-Nov	1.34	1.20	0.66	0.34	0.07	0.20		
29-Nov	1.89	0.26	1.51	0.14	0.14	0.14		
30-Nov	2.12	0.32	1.64	0.23	0.20	0.22		
1-Dec	1.89	0.31	1.53	0.24	0.17	0.21		
2-Dec	1.83	0.35	1.89	0.25	0.14	0.17		
3-Dec	1.02	0.28	0.94	0.27	0.18	0.45		
4-Dec	1.88	0.25	2.00	0.25	0.15	0.05		
5-Dec	0.84	0.34	1.26	0.23	0.14	0.05		
6-Dec	1.73	0.36	2.00	0.25	0.22	0.03		
7-Dec	0.66	0.31	1.18	0.22	0.18	0.06		
8-Dec	0.49	0.45	0.72	0.25	0.20	0.08		
9-Dec	1.47	0.81	2.45	0.25	0.31	0.11		
10-Dec	0.90	0.61	1.41	0.30	0.49	0.07		
11-Dec	0.48	0.12	1.88	0.40	0.36	0.04		
12-Dec	0.03	0.12	1.16	0.24	0.28	0.03		
13-Dec	0.21	0.17	1.53	0.17	0.04	0.05		
14-Dec	0.21	0.21	1.35	0.10	0.17	0.09		
15-Dec		0.20	0.67	0.14	0.18	0.09		
16-Dec		0.27	1.86	0.16	0.32	0.28		
17-Dec		0.23	0.84	0.17	0.65	0.23		
18-Dec	0.27	0.19		0.12	0.07	0.10		
19-Dec	0.45	0.23		0.28	0.23	0.19		
20-Dec	1.73	0.35		1.21	0.38	0.37		
21-Dec	0.43	0.38		1.33	0.33	0.26	1.17	
22-Dec	0.35	0.34		0.85	0.59	0.26	0.17	
23-Dec	0.08	0.08		0.19	0.40	0.09	0.09	
24-Dec	0.23	0.21		2.70	0.25	0.21	0.36	
25-Dec	1.21	0.24		5.49	0.50	0.17	0.92	
26-Dec	0.98	0.22		2.77	0.80	0.01	0.95	
27-Dec	0.36	0.21		0.12	0.05	0.03	0.67	
28-Dec	0.21	0.11		2.90	0.06	0.13	0.41	
29-Dec	0.41	0.11		4.77	0.06	0.09	3.02	
30-Dec	0.55	0.22		0.39	0.14	0.17	0.29	
31-Dec	0.45	0.23		0.55	0.17	0.13	0.27	

- ■ (>2 ppm)
- ■ (1- 2 ppm)
- ■ (0.5-1 ppm)
- ■ (0-0.5 ppm)

Daily variation in TVOC levels

Date	Location 1	Location 2	Location 3	Location 4	Location 5	Location6	Location 7	Location 8
30-Jan				0.12	0.45	0.21	0.16	0.53
31-Jan				0.16	0.51	0.40		0.66
1-Feb				0.52	0.96	0.55	0.21	0.56
2-Feb				0.84	0.98	0.67	0.23	1.33
3-Feb				0.37		0.47	0.13	0.73
4-Feb				0.32		0.31	0.06	0.46
5-Feb				0.40		0.42	0.13	0.94
6-Feb			1.12	0.65	0.15	0.23	0.19	0.87
7-Feb			0.86	0.55	0.16	0.45	0.19	0.69
8-Feb			0.40	0.32	0.15	0.43	0.18	0.36
9-Feb			0.25	0.26	0.19	0.24	0.16	0.18
10-Feb			0.48	0.55	0.20	0.27	0.21	0.40
11-Feb			0.77	0.53	0.19	0.27	0.41	0.63
12-Feb			0.34	0.89	0.15	0.41	0.30	0.39
13-Feb			0.26	0.27	0.08	0.33	0.09	0.18
14-Feb			0.33	0.33	0.14	0.29	0.03	0.27
15-Feb			0.26	0.40	0.19	0.32	0.09	0.18
16-Feb			0.25	0.33	0.12	0.46	0.18	0.22
17-Feb			0.33	0.68	0.26	0.32	0.28	0.30
18-Feb			0.02	1.28	0.24	0.29	0.18	0.27
19-Feb			9.07	0.39	0.43	0.20	0.82	1.29
20-Feb				0.31	0.38	0.25	0.50	0.70
21-Feb				16.29	0.67	0.33	0.21	0.45
22-Feb				27.57	0.65	0.24	0.35	0.60
23-Feb				0.16			1.27	1.51
24-Feb				0.11			1.14	1.31
25-Feb				1.93			0.47	1.72
26-Feb							0.42	1.31

■ (>2 ppm)

■ (1- 2 ppm)

■ (0.5-1 ppm)

■ (0-0.5 ppm)

Future works

- Co-location of sensor and SCAQMD sampling units
- Systematic evaluation on effect of wind direction/speed