Supplemental Information

Measurement System Evaluation for Upwind/Downwind Sampling of Fugitive Dust Emissions

John G. Watson[1,2*], Judith C. Chow[1,2], Li Chen[1], Xiaoliang Wang[1], Thomas M. Merrifield[3], Philip M. Fine[4], Ken Barker[5]

[1]Desert Research Institute, 2215 Raggio Parkway, Reno, NV, USA 89434
[2] Institute of Earth Environment, Chinese Academy of Sciences, 10 Fenghui South Road, Xi'an High-Tech Zone, Xi'an, China 710075
[3] BGI Incorporated, 58 Guinan Street, Waltham, MA, USA, 02451
[4]South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, CA, USA 91765
[5] Sully-Miller Contracting Co., 135 S. State College Boulevard, Brea, CA, USA 92821

SITE CONFIGURATIONS

Figures S-1 and S-2 show the layout of sampling instruments during downwind and upwind sampling at Facility B, respectively. Similar to Figures 3a and 3b in the main text for Facility A, particle sampler inlets were located 2 m above ground level. All but the hivol allowed for this adjustment. Leg extensions were put on the hivols to bring them to the desired heights. Samplers, including collocated measurements, were located at least 2 m from each other to avoid interference in sampling from the same air. Even so, samplers were at different distances from nearby sources which might affect their particle collection. Collocated sampling was conducted on a subset of samplers (i.e., hivol SSI, minivol OMNI, E-sampler, and DustTrak) before or after each field experiment at each facility to evaluate the reproducibility of the same type of sampler when used for concurrent upwind and downwind sampling.

[*]Corresponding author: Tel: 1-775-674-7046; Fax: 1-775-674-7009
E-*mail address*: john.watson@dri.edu

GRIMM OPC PARTICLE SIZE DISTRIBUTIONS

Figures S-3 and S-4 show the daily particle size distributions from the Grimm OPCs for Facilities A and B, respectively. The Grimm OPCs provide greater size resolution than the TSI DustTrak DRX, though this detail is probably unnecessary for this application. The bottom five bars in Figures S-3 and S-4 (0.3 to 1 μm) are approximately equivalent to the bottom bar in Figure 8 (0 to 1 μm) of the main text, while the top three bars in Figures S-3 and S-4 (10 to >20 μm) are approximately equivalent to the top bar in Figure 8 (10 μm to TSP) of the main text. The bottom 12 bars in Figures S-3 and S-4 (0.3 to 10 μm) and the bottom four bars in Figure 8 (0 to 10 μm) of the main text approximate the PM_{10} concentrations.

PLUME NON-UNIFORMITIES

Figure S-5 shows a 90 second sequence on September 26, 2008 in which a front-end loader drops a load and a dust plume approaches the DRX. The DRX was placed directly downwind of the source, but a minor change in wind direction caused the narrow plume bypass the monitor, as shown in the bottom three photographs.

WIND DIRECTION AND WIND SPEED VARIABILITY

The terms “upwind” and “downwind” have been used somewhat loosely to describe the sampling locations. Meteorological at all four locations can be examined to determine the extent to which such terms are applicable during the five-hour sampling periods. Tables S-1 to S-4 summarize the frequencies of winds within the sampling periods at each of the four sites during the study.

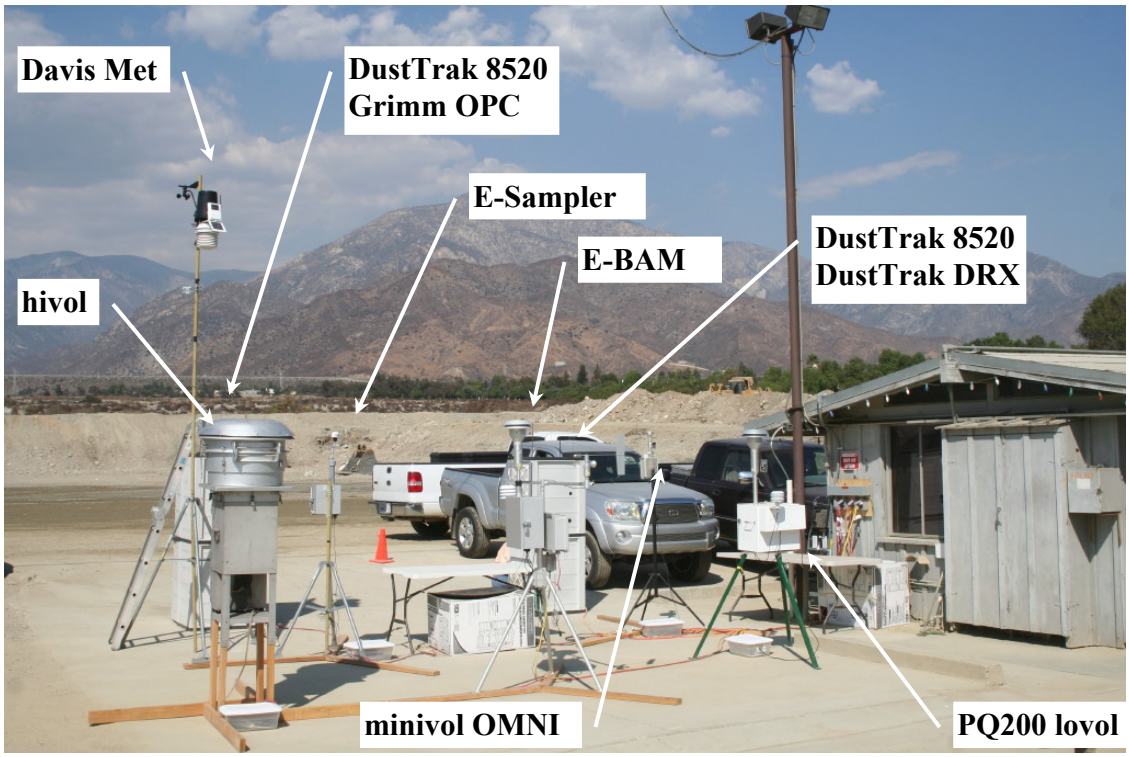


Figure S-1. Sampler configuration at downwind Site B-1 at Facility B, facing northeast.

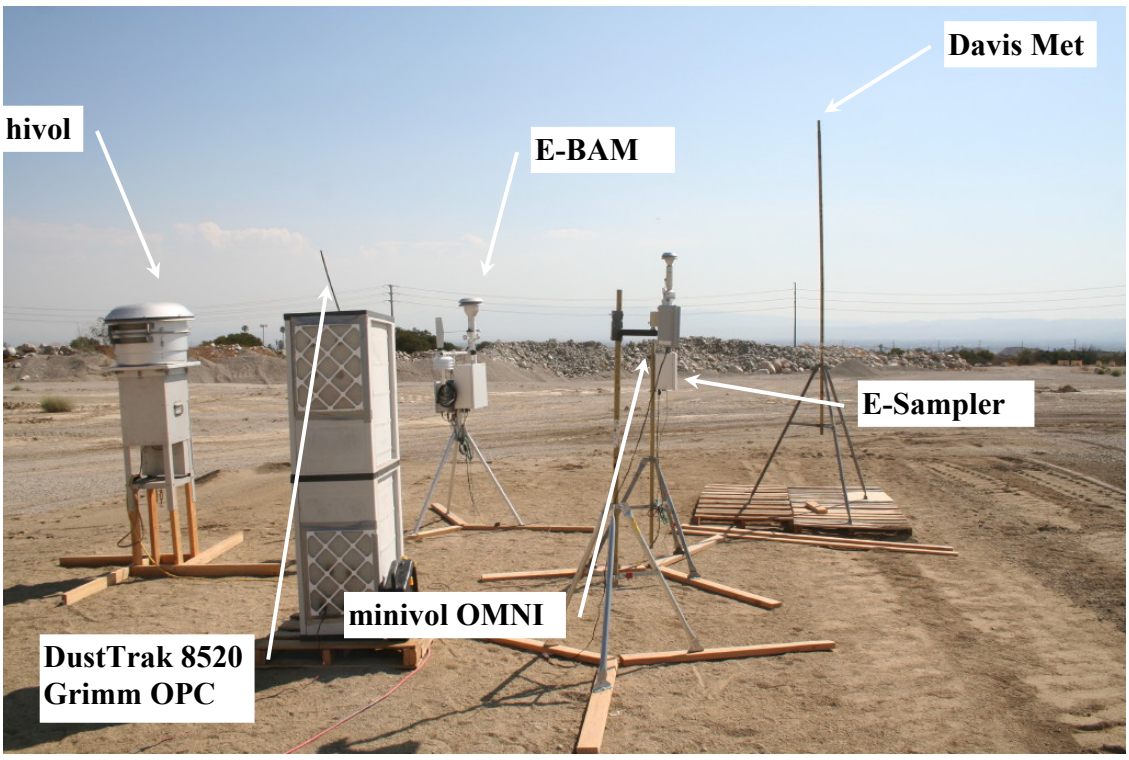
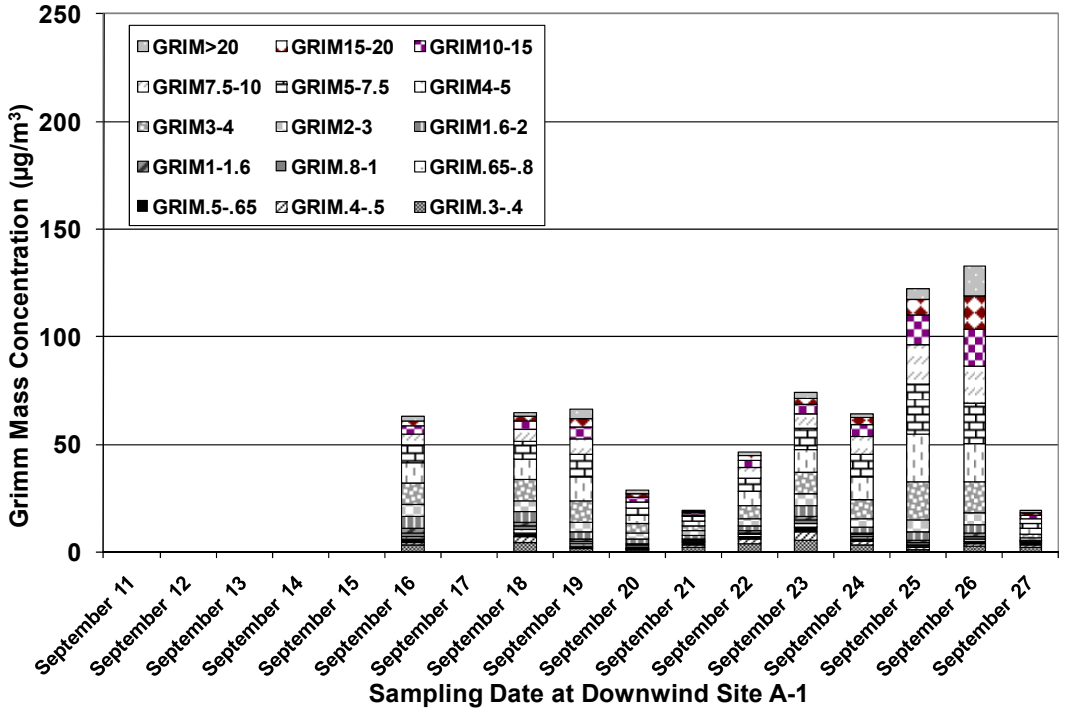


Figure S-2. Sampler configuration at the upwind Site B-2 at Facility B, facing south.

a)



b)

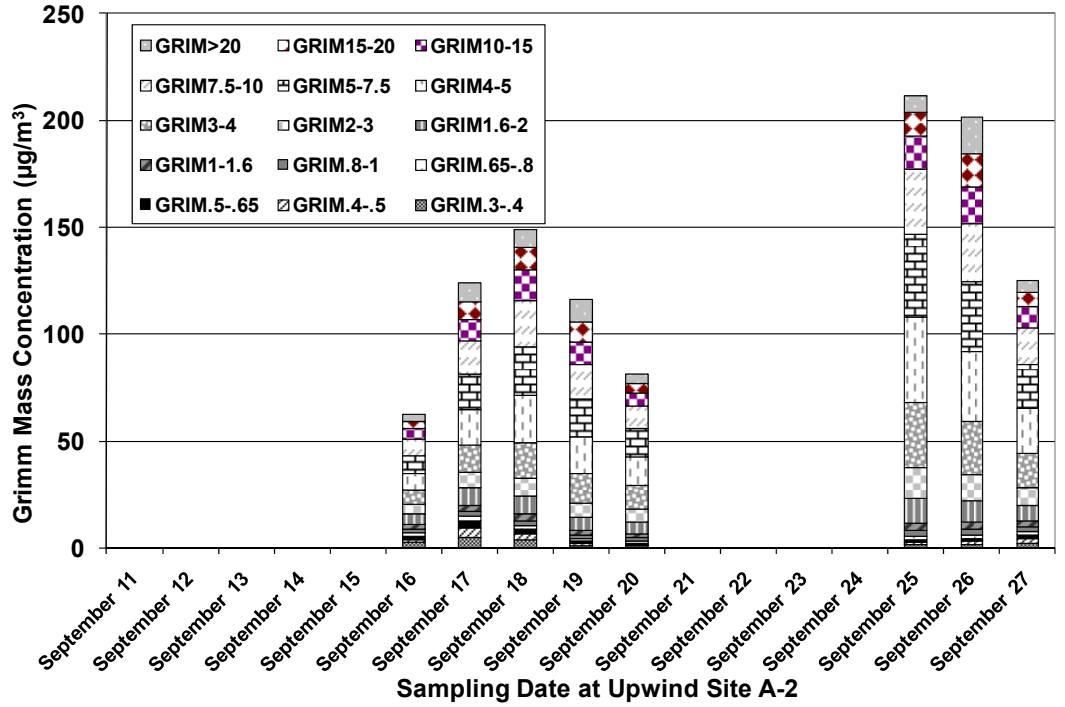
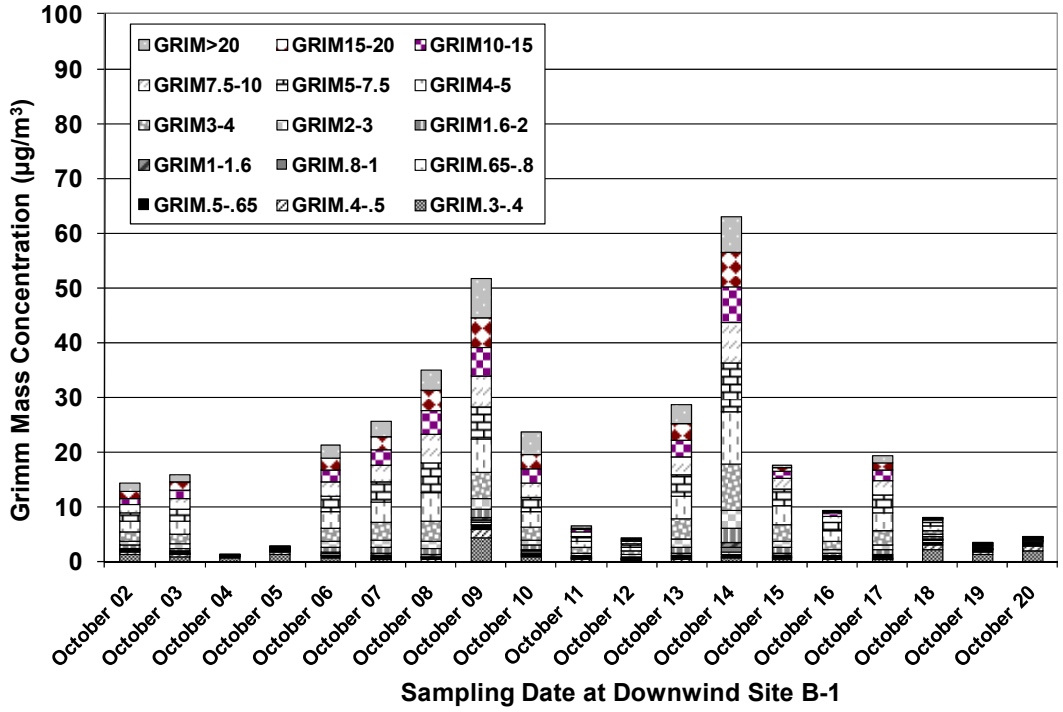


Figure S-3. Grimm OPC mass size distributions at Facility A: a) downwind Site A-1, and b) upwind Site A-2.

a)



b)

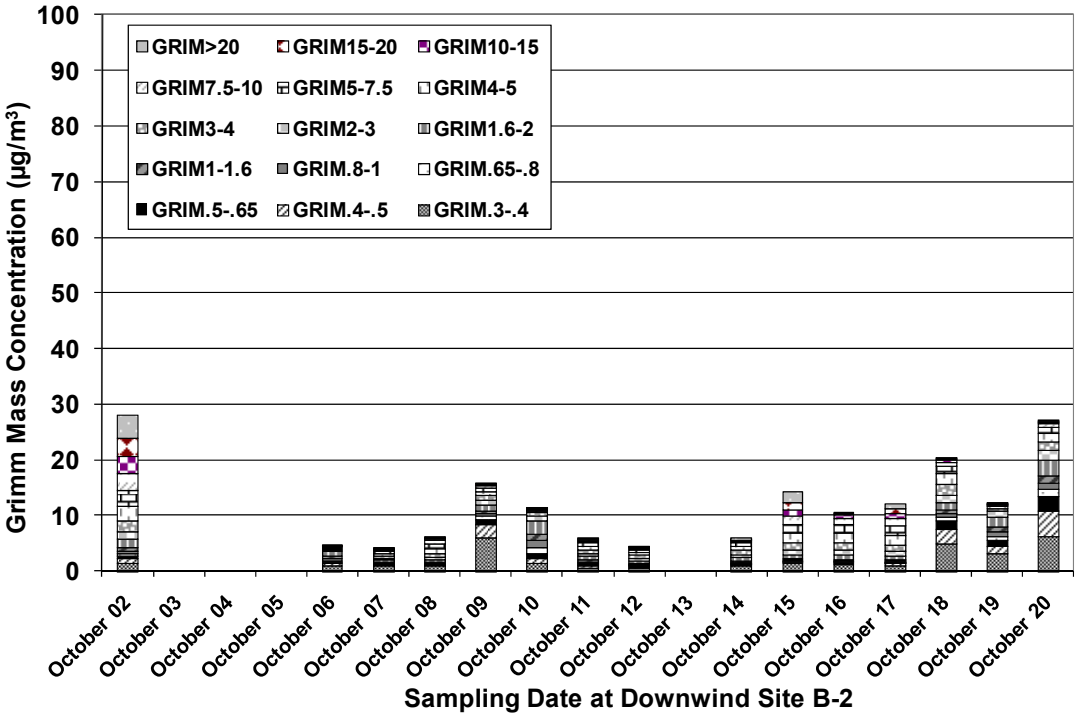


Figure S-4. Grimm OPC mass size distributions at Facility B: a) downwind Site B-1, and b) upwind Site B-2.

Figure S-5. A simulated fugitive dust event caused by a front-end loader dump near Site A-1 on September 26, 2008. Photographs are ~10 s apart. A slight change in wind direction causes the plume to bypass the sampler with minimal detection as shown in the bottom three panels.

Table S-1. Daily wind direction and wind speed frequencies (% of time) at downwind Site A-1 from 1100 to 1600 PDT during September 11–27, 2008 at Facility A.

Wind Direction	Sampling Date (2008)																	Total
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	
N	0.0	87.6	7.0	0.3	0.0	0.0	0.3	0.3	0.3	1.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	5.7
NNE	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.0	0.1
NE	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.3	2.3	0.3	0.3	0.0	0.0	0.0	0.3
SSE	0.3	0.0	0.3	1.0	0.0	0.0	0.7	0.7	0.0	1.0	3.3	5.0	1.3	0.0	0.0	0.7	0.7	0.9
S	1.0	0.7	1.3	9.0	1.0	2.7	8.0	9.7	12.4	16.4	16.4	14.0	14.4	5.0	4.3	5.7	4.0	7.4
SSW	11.0	2.7	16.7	12.4	12.0	11.4	11.0	13.0	19.7	18.4	14.0	16.4	15.7	13.7	9.4	13.0	10.0	13.0
SW	19.4	2.7	18.7	27.1	29.4	26.8	22.7	24.1	30.1	27.4	22.1	17.4	22.1	25.8	25.4	34.1	24.7	23.5
WSW	8.7	1.7	14.0	12.7	21.7	13.4	19.4	17.1	14.0	13.0	13.7	10.7	17.1	18.7	21.1	19.7	19.4	15.1
W	31.8	2.3	18.1	23.4	21.7	33.8	24.7	17.1	16.1	10.7	13.0	17.1	19.7	21.7	26.4	16.7	26.8	20.1
WNW	21.1	1.0	13.0	11.0	12.4	12.0	11.0	14.7	6.4	9.7	10.4	12.7	9.0	13.7	13.0	9.4	14.0	11.4
NW	5.0	0.7	4.7	2.7	1.3	0.0	2.0	2.3	0.7	2.3	3.0	3.0	0.0	1.0	0.3	0.7	0.3	1.8
NNW	1.7	0.7	0.3	0.0	0.3	0.0	0.0	1.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.3
Speed (m/s)	**9/11**	**9/12**	**9/13**	**9/14**	**9/15**	**9/16**	**9/17**	**9/18**	**9/19**	**9/20**	**9/21**	**9/22**	**9/23**	**9/24**	**9/25**	**9/26**	**9/27**	**Total**
0-0.5	0.0	87.6	7.0	0.3	0.0	0.0	0.3	0.3	0.3	1.0	0.3	0.0	0.3	0.0	0.0	0.0	0.0	5.7
0.5-1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.0	0.1
1-1.5	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1.5-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.5-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
3-3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	1.3	2.3	0.3	0.3	0.0	0.0	0.0	0.3
3.5-4	0.3	0.0	0.3	1.0	0.0	0.0	0.7	0.7	0.0	1.0	3.3	5.0	1.3	0.0	0.0	0.7	0.7	0.9
4-4.5	1.0	0.7	1.3	9.0	1.0	2.7	8.0	9.7	12.4	16.4	16.4	14.0	14.4	5.0	4.3	5.7	4.0	7.4
4.5-5	11.0	2.7	16.7	12.4	12.0	11.4	11.0	13.0	19.7	18.4	14.0	16.4	15.7	13.7	9.4	13.0	10.0	13.0
5-5.5	19.4	2.7	18.7	27.1	29.4	26.8	22.7	24.1	30.1	27.4	22.1	17.4	22.1	25.8	25.4	34.1	24.7	23.5
5.5-6	8.7	1.7	14.0	12.7	21.7	13.4	19.4	17.1	14.0	13.0	13.7	10.7	17.1	18.7	21.1	19.7	19.4	15.1
6-6.5	31.8	2.3	18.1	23.4	21.7	33.8	24.7	17.1	16.1	10.7	13.0	17.1	19.7	21.7	26.4	16.7	26.8	20.1

Table S-2. Daily wind direction and wind speed frequencies (% of time) at upwind Site A-2 from 1100 to 1600 PDT during September 11–27, 2008 at Facility A.

Wind Direction	Sampling Date (2008)																	Total
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	
N				0.3	1.0	0.0	0.0	0.3	0.3	0.0	1.0	1.3	0.3	0.0	0.3	0.0	0.3	0.4
NNE				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE				0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.1
SE				0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.0	3.0	0.0	0.0	0.0	0.7	0.0	0.4
SSE				0.3	0.0	0.0	0.7	2.3	2.3	1.0	3.7	5.7	1.7	0.7	0.0	0.0	0.0	1.3
S				1.0	0.0	0.7	1.7	4.7	4.3	5.0	7.0	10.4	4.3	0.3	1.0	3.0	1.0	3.2
SSW				12.0	10.0	6.0	6.4	13.0	21.4	24.4	17.4	14.7	22.7	20.1	11.4	10.4	10.4	14.3
SW				73.2	70.9	84.9	73.2	56.5	65.2	52.5	52.2	38.1	55.9	67.2	76.6	71.6	71.6	65.0
WSW				6.7	11.7	4.7	11.0	9.7	4.0	8.0	6.4	10.7	6.4	7.7	8.0	11.4	10.4	8.3
W				4.3	5.7	3.3	6.7	7.4	1.0	4.0	5.4	7.4	6.0	3.7	2.3	3.0	3.0	4.5
WNW				1.7	0.3	0.3	0.0	4.0	0.0	1.3	2.3	3.7	1.3	0.3	0.3	0.0	2.3	1.3
NW				0.3	0.3	0.0	0.0	1.3	1.0	3.0	2.3	3.3	1.3	0.0	0.0	0.0	1.0	1.0
NNW				0.0	0.0	0.0	0.0	0.7	0.3	0.3	0.3	0.7	0.0	0.0	0.0	0.0	0.0	0.2
Speed (m/s)	**9/11**	**9/12**	**9/13**	**9/14**	**9/15**	**9/16**	**9/17**	**9/18**	**9/19**	**9/20**	**9/21**	**9/22**	**9/23**	**9/24**	**9/25**	**9/26**	**9/27**	**Total**
0-0.5				15.1	12.7	0.7	9.7	19.4	3.3	12.4	17.4	31.4	15.1	8.4	10.7	14.4	9.0	12.8
0.5-1				20.1	15.7	3.0	15.1	20.4	4.7	16.1	20.7	26.4	19.1	20.1	14.0	12.0	13.7	15.8
1-1.5				26.1	16.1	10.4	22.1	19.1	6.7	19.1	26.1	26.4	27.1	27.4	19.4	17.4	17.7	20.1
1.5-2				19.4	26.1	33.4	26.8	13.7	12.4	17.7	24.1	11.7	26.4	21.7	17.4	18.4	24.7	21.0
2-2.5				13.4	17.7	29.1	20.7	13.7	22.1	18.1	9.4	4.0	10.7	15.4	15.4	20.7	17.7	16.3
2.5-3				6.0	9.4	15.7	4.7	7.7	25.1	13.7	2.3	0.0	1.7	6.4	14.4	12.0	12.7	9.4
3-3.5				0.0	2.3	6.0	1.0	5.0	20.7	3.0	0.0	0.0	0.0	0.7	6.0	5.0	4.0	3.8
3.5-4				0.0	0.0	1.7	0.0	1.0	3.7	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.3	0.7
4-4.5				0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
4.5-5				0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-5.5				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.5-6				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-6.5				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S-3. Daily wind direction and wind speed frequencies (% of time) at downwind Site B-1 from 1100 to 1600 PDT during October 2–20, 2008 at Facility B.

Wind Direction	Sampling Date (2008)																			Total
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	
N	0.0	41.5	1.0	1.7	0.0	0.7	1.0	0.3	2.0	3.7	5.0	1.0	0.3	1.3	1.7	1.3	0.7	0.7	0.0	3.4
NNE	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	1.3	1.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.2
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	1.0	1.3	0.0	1.3	0.0	0.3	0.0	0.0	0.0	0.2
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.7	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
E	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.3	1.0	0.3	0.0	0.3	0.7	1.7	0.0	0.0	0.0	0.4
ESE	0.3	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	1.3	0.3	0.3	0.0	0.0	2.0	3.0	0.0	0.0	0.0	0.5
SE	0.3	0.0	0.0	0.0	0.0	0.0	4.3	0.3	0.0	2.0	0.3	1.0	0.0	0.3	0.0	4.0	0.0	0.0	0.0	0.7
SSE	4.0	0.0	0.0	0.3	0.0	0.0	8.4	0.3	0.0	2.7	0.7	3.3	0.0	0.3	0.7	9.7	0.0	0.0	0.0	1.6
S	4.3	0.0	0.0	1.7	0.0	4.3	11.7	1.7	0.0	6.0	1.3	1.7	0.0	0.3	1.0	17.7	0.7	0.0	0.0	2.8
SSW	4.7	0.0	0.0	5.0	0.0	4.7	13.4	3.7	0.3	10.7	4.0	13.7	0.0	1.0	6.7	26.4	2.0	0.0	0.0	5.1
SW	4.3	0.7	0.0	11.0	3.0	11.7	10.7	6.7	4.0	11.4	2.7	12.0	0.0	3.7	11.4	11.4	3.0	0.0	2.7	5.8
WSW	23.4	5.4	1.0	21.7	18.7	19.7	11.7	10.0	10.0	10.0	9.4	16.7	1.0	7.0	17.4	8.7	4.3	6.4	5.4	10.9
W	41.5	32.8	42.1	45.8	63.2	36.8	28.1	55.5	62.2	21.7	29.1	21.1	20.7	15.4	21.1	7.7	27.1	35.5	37.1	33.9
WNW	11.0	6.0	16.1	5.7	8.4	10.0	2.0	12.4	14.0	12.7	23.4	18.7	54.2	49.2	27.8	6.7	50.5	50.5	50.2	22.6
NW	6.0	12.4	23.1	5.4	6.0	9.7	1.0	8.4	5.7	8.7	7.4	4.7	16.7	12.0	3.7	0.7	7.0	3.3	3.3	7.6
NNW	0.0	1.3	16.7	1.3	0.7	2.3	1.0	0.7	1.7	6.7	12.4	3.0	7.0	7.7	5.0	0.7	4.7	3.7	1.3	4.1
Speed (m/s)	**10/2**	**10/3**	**10/4**	**10/5**	**10/6**	**10/7**	**10/8**	**10/9**	**10/10**	**10/11**	**10/12**	**10/13**	**10/14**	**10/15**	**10/16**	**10/17**	**10/18**	**10/19**	**10/20**	**Total**
0-0.5	2.0	42.1	3.7	5.0	0.0	10.4	22.4	2.3	1.7	16.4	10.4	6.4	0.3	17.4	10.4	9.7	4.0	0.0	1.7	8.7
0.5-1	3.0	1.0	11.0	8.0	3.0	20.4	11.0	5.4	1.0	10.7	13.4	8.7	1.3	24.4	13.0	13.4	8.4	3.7	3.3	8.6
1-1.5	9.4	5.4	23.7	17.7	5.4	27.1	13.0	11.4	4.7	19.4	19.4	8.4	13.7	25.1	25.1	13.0	14.0	7.7	21.1	15.0
1.5-2	14.0	11.4	24.4	16.1	22.1	22.4	10.4	16.1	8.7	16.7	19.1	17.1	20.1	16.1	22.7	18.7	18.7	19.4	24.4	17.8
2-2.5	13.0	13.7	18.1	20.1	23.1	11.7	9.7	20.4	12.4	13.4	16.4	18.4	27.8	7.7	16.4	19.1	18.1	24.4	17.4	16.9
2.5-3	15.7	11.4	11.0	13.0	18.7	5.0	10.4	13.0	19.4	11.0	11.0	12.4	16.7	4.0	8.4	9.7	11.0	21.7	15.7	12.6
3-3.5	12.0	7.0	5.0	11.0	16.4	2.3	7.0	9.7	16.4	7.7	6.4	13.4	11.0	4.7	2.7	8.7	15.1	11.4	12.0	9.5
3.5-4	11.4	4.3	2.0	5.0	7.7	0.3	6.7	8.7	12.4	2.7	2.7	9.4	7.4	0.3	0.7	5.4	6.0	8.4	3.3	5.5
4-4.5	4.0	2.3	0.7	2.3	2.3	0.3	4.0	5.0	9.4	1.7	1.0	2.3	0.7	0.3	0.7	0.7	4.0	3.0	1.0	2.4
4.5-5	11.4	1.0	0.3	1.7	1.3	0.0	4.7	8.0	13.0	0.3	0.3	3.3	1.0	0.0	0.0	1.7	0.7	0.3	0.0	2.6
5-5.5	2.3	0.3	0.0	0.0	0.0	0.0	0.7	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
5.5-6	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
6-6.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table S-4. Daily wind direction and wind speed frequencies (% of time) at upwind Site B-2 from 1100 to 1600 PDT during October 2–20, 2008 at Facility B.

Wind Direction	Sampling Date (2008)																		Total
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	
N	0.0	0.0	0.0	0.0	0.0	0.7	1.0	0.0	0.0			0.3	0.0	0.0	1.0	2.3	0.0	0.0	0.0	0.3
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.1
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0			0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.1
E	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0			0.3	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.7
ESE	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0			4.7	0.0	0.0	0.0	20.4	0.0	0.0	0.0	1.7
SE	0.7	0.0	0.0	0.0	0.0	0.3	10.7	0.0	0.0			4.3	0.0	0.0	0.0	17.4	0.3	0.0	0.0	2.0
SSE	0.0	0.0	0.0	0.0	0.0	2.0	14.0	0.3	0.0			7.4	0.0	0.0	0.3	8.7	0.0	0.0	0.0	1.9
S	6.0	0.0	0.0	5.4	0.0	4.3	6.0	1.7	0.0			7.4	0.0	1.7	7.4	10.7	2.3	0.0	1.0	3.2
SSW	4.0	2.0	0.0	7.7	0.3	6.4	6.7	5.7	4.0			15.4	0.0	9.4	11.4	7.7	5.0	0.3	2.0	5.2
SW	7.4	11.4	0.0	21.7	12.4	24.1	21.4	14.7	25.4			20.4	1.3	20.4	23.4	6.7	11.0	15.1	20.1	15.1
WSW	44.1	36.8	22.7	32.1	44.1	27.4	21.7	35.5	39.8			18.7	47.5	31.1	28.1	7.7	48.2	50.8	46.8	34.3
W	34.4	39.8	45.5	26.1	40.8	21.7	7.4	36.5	27.8			20.1	47.5	27.1	19.1	5.4	30.1	33.1	28.4	28.9
WNW	3.3	8.4	22.1	6.4	2.3	9.0	2.0	5.7	3.0			0.7	3.7	8.0	7.4	2.7	3.0	0.7	1.7	5.3
NW	0.0	1.0	9.7	0.7	0.0	3.7	0.3	0.0	0.0			0.3	0.0	2.0	1.3	0.0	0.0	0.0	0.0	1.1
NNW	0.0	0.7	0.0	0.0	0.0	0.3	0.0	0.0	0.0			0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0	0.1
Speed (m/s)	**10/2**	**10/3**	**10/4**	**10/5**	**10/6**	**10/7**	**10/8**	**10/9**	**10/10**	**10/11**	**10/12**	**10/13**	**10/14**	**10/15**	**10/16**	**10/17**	**10/18**	**10/19**	**10/20**	**Total**
0-0.5	0.7	0.3	0.0	2.3	0.0	4.7	9.4	0.7	0.0			5.0	0.0	7.7	6.0	1.7	1.3	0.0	0.0	2.3
0.5-1	1.7	2.0	0.0	3.3	0.3	6.4	9.7	3.0	0.3			5.0	0.0	8.4	5.4	4.7	2.3	0.0	0.3	3.1
1-1.5	1.7	1.0	0.0	5.0	2.0	14.7	14.7	3.7	0.7			6.4	0.0	14.7	12.7	7.4	5.4	0.3	5.7	5.6
1.5-2	4.7	3.0	2.0	10.4	2.3	24.7	8.7	8.0	1.7			7.0	0.7	24.7	15.7	11.0	7.4	1.3	7.7	8.3
2-2.5	3.0	5.7	13.4	14.7	8.0	17.7	8.4	11.4	1.7			8.0	2.3	14.0	19.7	11.7	10.0	5.7	21.4	10.4
2.5-3	5.7	9.0	28.1	18.7	11.0	17.4	10.4	8.0	5.4			11.0	5.7	15.1	17.1	15.1	8.7	20.4	13.7	13.0
3-3.5	7.0	17.4	32.1	18.7	22.7	7.7	6.7	10.4	12.0			16.1	18.7	11.0	10.4	19.4	19.1	22.1	19.4	15.9
3.5-4	9.4	19.4	18.1	13.7	29.4	4.0	6.0	17.1	17.4			11.7	33.1	2.7	9.4	13.7	17.1	21.1	17.7	15.3
4-4.5	15.7	18.1	5.7	10.0	17.7	2.3	5.0	13.7	17.7			11.0	27.8	1.3	3.0	9.4	17.7	17.4	9.7	12.0
4.5-5	33.8	20.1	0.7	3.0	6.4	0.3	13.0	21.1	25.4			15.7	11.4	0.3	0.7	6.0	10.4	11.4	4.3	10.8
5-5.5	11.4	3.0	0.0	0.0	0.0	0.0	4.3	2.3	8.4			2.0	0.3	0.0	0.0	0.0	0.7	0.3	0.0	1.9
5.5-6	5.0	1.0	0.0	0.0	0.0	0.0	3.0	0.3	4.7			0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9