PM_{10} Exceptional Events Waiver Request

Parkgate station in Eagle River, AK (AQS ID = 02-020-1004-81102-3) and
DHHS station in Anchorage, AK (AQS ID = 02-020-0052-81102-3)

September 24, 2010

Air Quality Program
Department of Health and Human Services
Municipality of Anchorage

March 2013

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A. Event criteria

Event affected air quality

In late September 2010, a weather system surrounding Alaska created a large pressure gradient over south-central Alaska, and this resulted in extremely strong north winds that blew across the region on September 24th, 2010. This weather pattern is fairly common in this region and a resulting strong northerly wind is locally known as a Matanuska Wind. The Matanuska Wind of September 24th, 2010 was unusually strong, however, causing a number of power outages both in the Matanuska-Susitna (Mat-Su) Borough and the Municipality of Anchorage (Appendix A). This Matanuska Wind, accompanied by dry weather and snow-free conditions, generated massive wind-blown dust clouds from glacial outwash of major glacial rivers across the entire region (Figure 1).

On September 24th, The Municipality of Anchorage issued an Air Quality Advisory because the PM_{10} concentration was approaching unhealthy levels due to airborne dust transported from the Matanuska Valley. An Air Quality Warning was also issued by the Mat-Su Borough for the Palmer, Wasilla, Sutton, and Chickaloon areas (Appendix B).

The unusually dusty conditions were reflected in PM_{10} concentrations monitored adjacent to the Matanuska River delta in Palmer and at monitoring sites downwind of the delta in Eagle River and Anchorage (Table 1). The 24-hr averages of PM_{10} at all three monitoring stations recorded higher than normal ambient concentrations. The 24-hr PM_{10} concentration at the Parkgate monitoring station in Eagle River was 208 $\mu g/m^3$ on September 24th (AQS ID 02-020-1004-81102-3) and the 24-hr PM_{10} concentration at the Department of Health and Human Services (DHHS) station was 180 $\mu g/m^3$ (AQS ID 02-020-0052-81102-3). The monitor at the Palmer site (AQS ID 02-070-0012-85101-3) recorded elevated PM_{10}LC concentrations. (Table 1, Figure 1).

Table 1. The 24-hr average PM_{10} concentrations at Eagle River site and other monitoring sites across south-central Alaska. Data at Eagle River and Anchorage were obtained by the Municipality of Anchorage. Data at Wasilla and Palmer were obtained by the Alaska Department of Environmental Conservation. Asterisks indicate the events requested for consideration as exceptional events.

Monitoring station ID		Directly downwind from Matanuska Valley?	24-hr average PM_{10} ($\mu g/m^3$)		
Site	Station		23 Sept	24 Sept	25 Sept
Palmer	Palmer	Yes	NA	119#	36#
Eagle River	**Parkgate**	**Yes**	**40**	**208***	**48**
Anchorage	**DHHS**	**Yes**	**65**	**180***	**31**

Palmer values are PM-10 LC (Local Condition) data.

Source: EPA, Air Quality System database

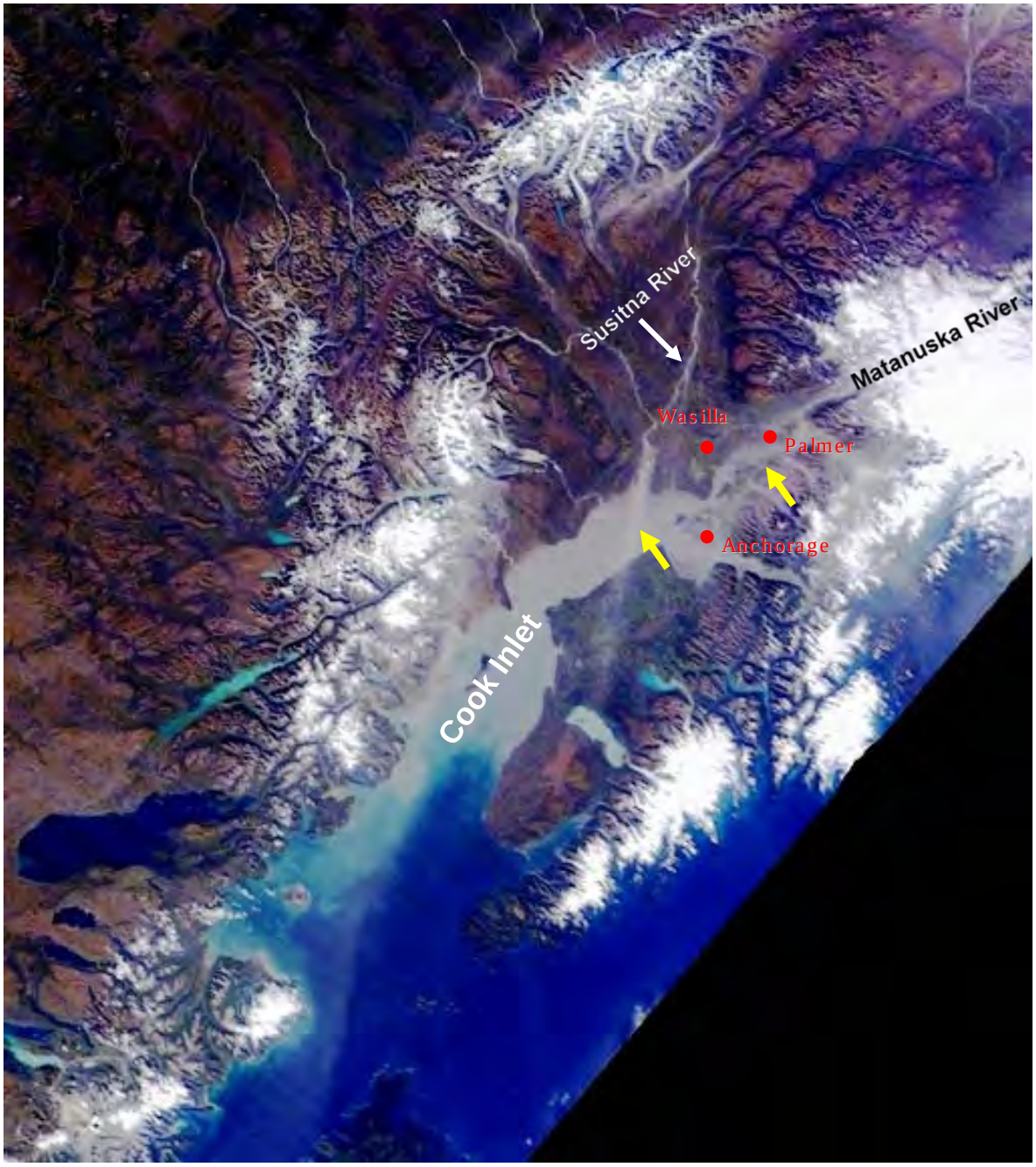


Figure 1 . AVHRR Satellite image of windblown dust in entire south-central Alaska at 14:49 AKDT on 24 September, 2010. Yellow arrows show dust plumes trailing from NE to SW. The dust plume from the Susitna River is especially prominent; plumes from the Matanuska River delta near Palmer can also be seen. Note that valley bottoms and plains are snow free. (source: NASA)

Event was not reasonably controllable or preventable

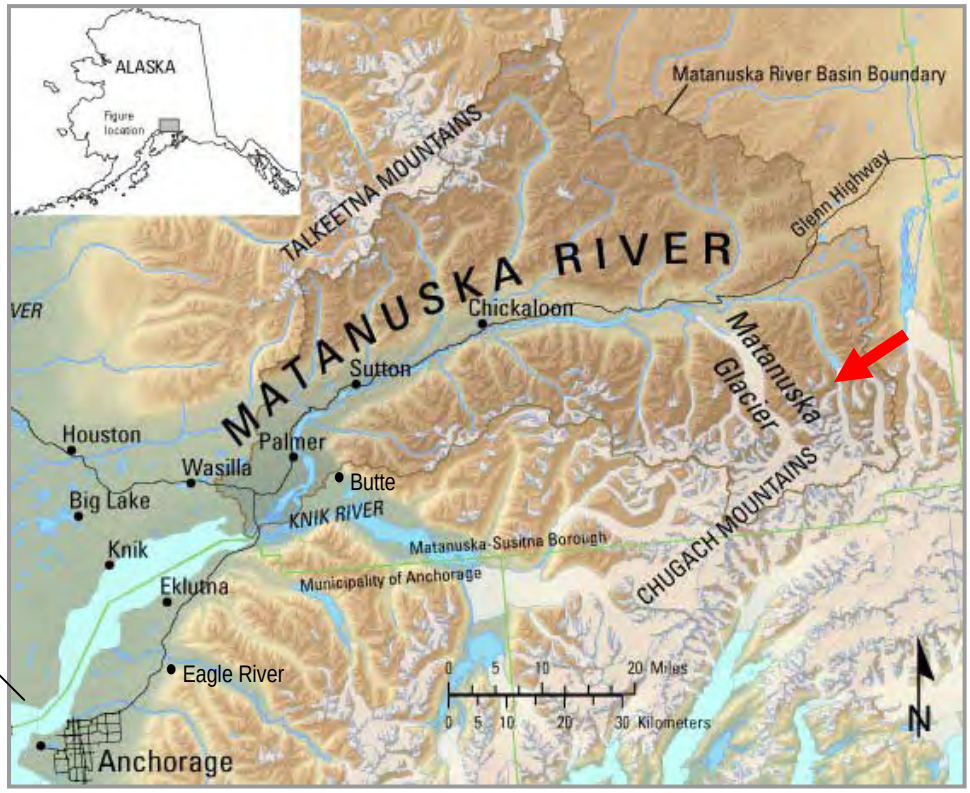
As we will describe below in detail, the key factors leading to the exceedance at the Parkgate and DHHS monitoring stations were: (1) **a large naturally-occurring reservoir of loose glacial silt deposits** on the glacial outwash plain along the Matanuska River; (2) **unusually strong north winds (Matanuska Wind)** capable of picking up and transporting the silt deposits; (3) **the absence of snow cover** on the ground, and; (4) **dry conditions** in the entire region that allowed the entrainment and long-range transport of dust. We will show that the human-caused component was negligible, thus the event was not controllable or preventable.

We define "unusually strong wind" as wind with maximum wind gust of greater than 35 mph. Weather records from at the Anchorage International Airport (PANC) from the 18 year period from 1993 through 2010 indicates that winds of speeds greater than 35 mph are rare. Approximately 3% of the days during this period recorded maximum wind gusts of greater than 35 mph. We have used wind data from PANC (~18 miles SW of Eagle River and the most comprehensive weather data available) and Birchwood Airport (PAVB), the nearest NWS weather station to Eagle River, ~6 miles northeast of Eagle River [1] and 20 miles northeast of Anchorage, and the Palmer Airport (PAAQ).

▪ *Natural PM_{10} sources*

Alluviation of wind-blown glacial silt (aeolian silt or loess) is a well recognized soil-forming process along Matanuska Valley and in its vicinity[2]. The silts are produced through grinding by the Matanuska glaciers and are transported downstream by the Matanuska River (Figure 2). Along the river, silty materials are constantly deposited and eroded, forming a braided outwash plain, which is highly susceptible to wind erosion if not vegetated (Figure 3).

Figure 2. Map of the Matanuska Valley area. The Matanuska glacier (red arrow) is an active glacier, continually adding silt to the Matanuska River.



(Original USGS map available at http://ak.water.usgs.gov/MatSu/mrbe/data_pubs.php was modified)

[1] Weather data were obtained from NCDC Quality Controlled Local Climatological Data (DS3505)

[2] Soil Survey of Matanuska-Susitna Valley Area, Alaska. United States Department of Agriculture, Natural Resources Conservation Service (Aug 1998).

Because glacial braided rivers constantly change their course, they prevent the establishment of vegetation on the outwash pain that could effectively suppress wind erosion. Along the upper stretch of the river the outwash plain is protected from winds by the narrow and deep Matanuska Valley, whereas the lower stretch of the river (a segment between Sutton, where the valley widens, and the river delta near Palmer) is subject to wind erosion (Figure 2). Within this segment, the total area of naturally-forming unvegetated outwash plain is estimated to be roughly 13 km^2 or 3,212 acres (personal communication with Janet Curran, USGS Alaska Science Center). Upstream of Sutton, human impact on land is negligible. Along the section between the glacier and the mouth of the river, there are no dams or flood control structures. Only a few erosion control structures (e.g., sand bags and rip rap) can be found along the banks of the river, keeping houses and roads from falling into the river. However, the total coverage by these structures is negligible relative to total unvegetated outwash plain.

Figure 3. Matanuska River and its expansive braided outwash plane.

(source: USGS ak.water.usgs.gov/MatSu/mrbe/index.php)

- *Relative importance of open areas created by human activities*

Open areas created by current and past human activities appeared to have contributed little, if any, to the elevated PM_{10} level during the event. A considerable portion of agricultural land near the Matanuska Valley is dedicated to perennial hay production and pasture. These areas are not a source of wind-blown dust because they remain vegetated year-round; a stubble remains even after hay is cut for harvest. In 2007, total agricultural land that was most likely tilled or turned was estimated to be only 2 km^2 or 494 acres.[3] In comparison, the unvegetated area of

[3] According to the latest available census results (2007) reported by the National Agricultural Statistics Service (NASS), total harvested crop land was estimated to be 69 km^2 for the "Anchorage census area", an area that extends roughly 50-100 miles radius of Palmer and includes Anchorage and Point MacKenzie (see Figure 2). In 2007 field crops comprised approximately 6% of total agricultural land. Thus, we estimated that the 2007 annual field crop land for the Anchorage census area was roughly 4 km^2. Because roughly half or more of the crop land in this census area is outside of the Matanuska Valley – Palmer – Butte area (i.e., in the Point MacKenzie area), we simply divided the area estimate by half.

braided outwash plain of the Matanuska River is about six times greater. We conservatively assumed that agricultural land use and practice in 2010 was similar to that in 2007, although there has been a general decline in total crop land over the past decade.[4]

Because of Alaska's short growing season, annual field crops are normally harvested by late August and the land is normally turned by mid to late September for the next spring. It is possible that some land may have been recently tilled before the September 24th, 2010 wind event and was perhaps more susceptible to wind-blown dust.[5] However, on-site inspection by municipal air quality staff on the day of the event suggested that tilled fields were a negligible source of dust relative to the river channel (Figure 4).

Figure 4. Agricultural land in the Palmer area September 24th, 2010. Note that little dust is being generated from unvegetated portion of the field.

Photo – Yuriko Yano, Municipality of Anchorage Air Quality Program

The only other sizeable open area along the route of the N-NE Matanuska wind is the Wishbone Hill Mine, located approximately 5 miles west of Sutton. This small historical mine consists of multiple mined locations (total area of roughly 1 km^2) last mined in 1980s. Currently, the Wishbone Hill area is largely re-forested and is now used for recreational activities for the local residents, including hiking and fishing. Dirt trails and roads along the trajectory of Matanuska wind were likely not significant sources for the wind-blown dust during the wind storm, because the total area of the trails is negligible relative to the braided outwash plain of the Matanuska River. Moreover, most trails run through wooded land that is sheltered from wind[6].

[4] Census results (2007) reported by NASS. Available at: http://www.agcensus.usda.gov/

[5] EPA document AP-42, Compilation of Air Pollutant Emission Factors, section 13.2.5 notes that soil turning disturbs the natural crusting of the surface and increases erosion potential. However, other sources suggest that soil turning creates a rough ground surface which can suppress wind-blown dust emissions. For example, the Arizona Department of Environmental Quality (ADEQ) includes tilling as a best management practice for controlling PM_{10} emissions from agricultural fields. (Guide to Agricultural PM10 Best Management Practices, Governor's Agricultural Best Management Practices Committee, ADEQ, Second edition, 2008, p. 27.)

[6] Along the trajectory of the Matanuska Wind, the only trail network for local off-highway vehicle (OHV) users are trails in the Wishbone Hill area. Even if we assume a high estimate of 100 miles for the total length of these trails, their total area would be only 0.2 km^2, assuming that the average trail width is 4 ft. This is less than 2% of braided outwash plain (13km^2). Most of these and other dirt trails weave through wooded lands that consist of mature and young paper birch, aspen, white spruce, willow, and other shrub cover.

Natural causes led to the event.

Normally, Matanuska Winds blow during the time when the ground is covered with snow and ice. However, occasionally these winds coincide with a dry period with little or no snow cover on the ground (e.g., late snow event, dry winter, and early snowmelt). This results in dust generation from the silt deposits in the glacial outwash and the transport of the dust toward downwind areas (Figure 5)[7].

Recent studies have revealed that long-range transport of PM_{10} is an important natural geochemical process on Earth. During severe wind storm events, millions of tons of soil may be transported thousand of kilometers, even to another continent. Intercontinental transport of dust from African and Chinese deserts to North America has been documented by satellite images and chemical analyses[8]. Thus, it is not surprising that the glacial silt deposits of the Matanuska River Valley can be transported to nearby cities such as Eagle River and Anchorage (less than 60 km away) when strong wind storms coincide with other environmental factors conducive to dust generation.

Figure 5. Formation and transport of wind-blown dust as a natural soil-forming process in Palmer, AK and its down-wind areas. Photograph is taken in Palmer. Background is Pioneer Peak. Note that ground is snow free.

(source: Soil Survey of Matanuska-Susitna Valley Area, Alaska. USDA NRCS, 1998)

[7] Soil Survey of Matanuska-Susitna Valley Area, Alaska. United States Department of Agriculture, Natural Resources Conservation Service (Aug 1998).

[8] Prospero JM (1999) Long-range transport of mineral dust in the global atmosphere: Impact of African dust on the environment of the southeastern United States. *PNAS.* 96:3396-3403.

Griffin DW et al. (2001) Dust in the Wind: Long Range Transport of Dust in the Atmosphere and Its Implications for Global Public and Ecosystem. *Global Change & Human Health.* 2:1389-5702.

Based on the three points listed below, we concluded that the exceedances on September 24th, 2010 at the Parkgate and DHHS monitoring stations were caused by glacial dust transported by an unusually strong Matanuska Wind and not by anthropogenic sources.

1. The Parkgate and DHHS monitoring sites are surrounded by urbanized land to the north, south, east and west (Figures 6 and 7). If anthropogenic sources were responsible for high PM_{10} concentrations, it is reasonable to expect that elevated PM_{10} would be associated with all wind directions.[9] However high PM_{10} concentrations have occurred only when strong winds rise from the north (Table 2 A). When high winds rise from the south or southeast, PM_{10} concentrations have been consistently low (Table 2 B).[10]
2. Although no source apportionment analysis was performed for this event, previous analyses have consistently demonstrated that crustal, geological materials are the predominant component of PM_{10} in both Eagle River and Anchorage[11]. The very low carbon content indicates that PM_{10} derived from combustion sources such as wood burning and industrial activity are not important sources of PM_{10} in Eagle River and Anchorage.
3. Finally, no unusual human activities that could have emitted a large amount of PM_{10} were recorded in Eagle River or Anchorage during the exceedance event.

[9] In most of Anchorage and Eagle River, wind gusts exceeding 35 mph rarely occur from directions other than north/northeast or south/ southeast.

[10] Strong southeast winds are often accompanied by precipitation which would likely suppress $PM_{10.}$ Snow cover also suppresses PM_{10}. If the comparison is narrowed to days when there was no precipitation on the day of or the day prior to the wind event, and there was no snow cover, the median PM_{10} concentration when strong winds rose out of the north was 147 $\mu g/m^3$ and just 35 $\mu g/m^3$ when they rose out of the south. (See data highlighted in yellow in Table 2A and 2B).

[11] The following studies support the predominance of crustal geologic materials contributing to the composition of PM-10 in Anchorage and Eagle River:

Aerosol Characterization Study of Anchorage, Alaska: Chemical Analysis and Source Apportionment, Final Report Vol. 1, Pritchett and Cooper, (Feb 1985).

Source Apportionment by Chemical Mass Balance Technique of PM-10 Sources in Eagle River and Juneau, Alaska, Final Report, Cooper and Sherman, (May 1988).

Source of Particles on PM10 Filters, Report NO. 1062-94, Mircolab Northwest, (Oct 1994).

CCSEM Analysis of Ten PM-10 Quartz Filters, Order No. 47159, RJ LeeGroup, Inc., (Mar 1995).

Identification, Quantification, and Control of PM-10 Sources in Anchorage, Midwest Research Institute, Project No. 4576, (Apr 1999).

Figure 6. Urbanized areas surrounding the Parkgate site in Eagle River. The Parkgate site (shown as callout A) is surrounded by urban/suburban development in all directions.

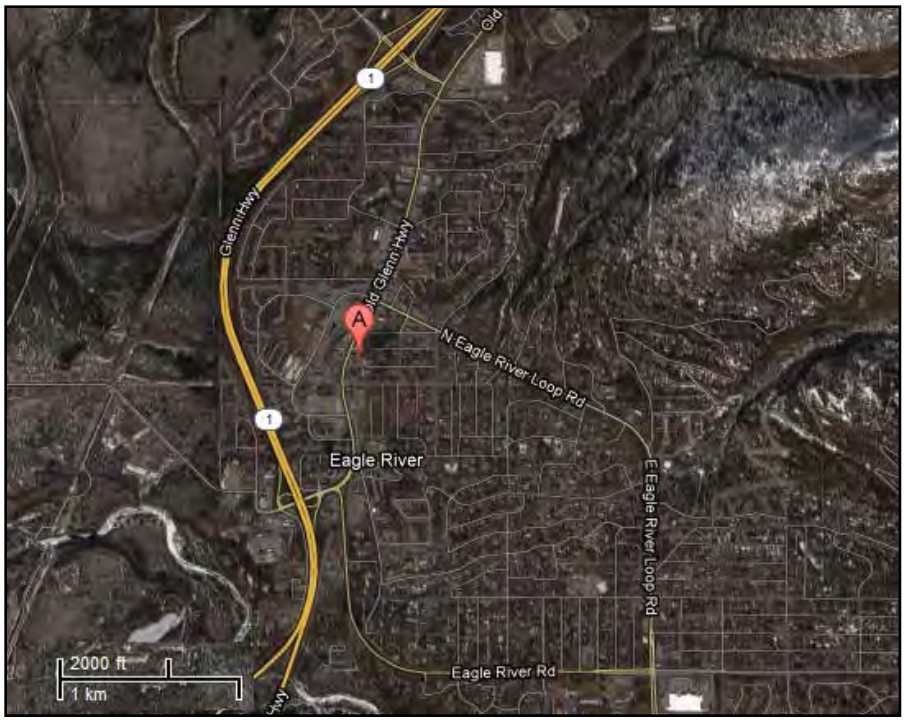
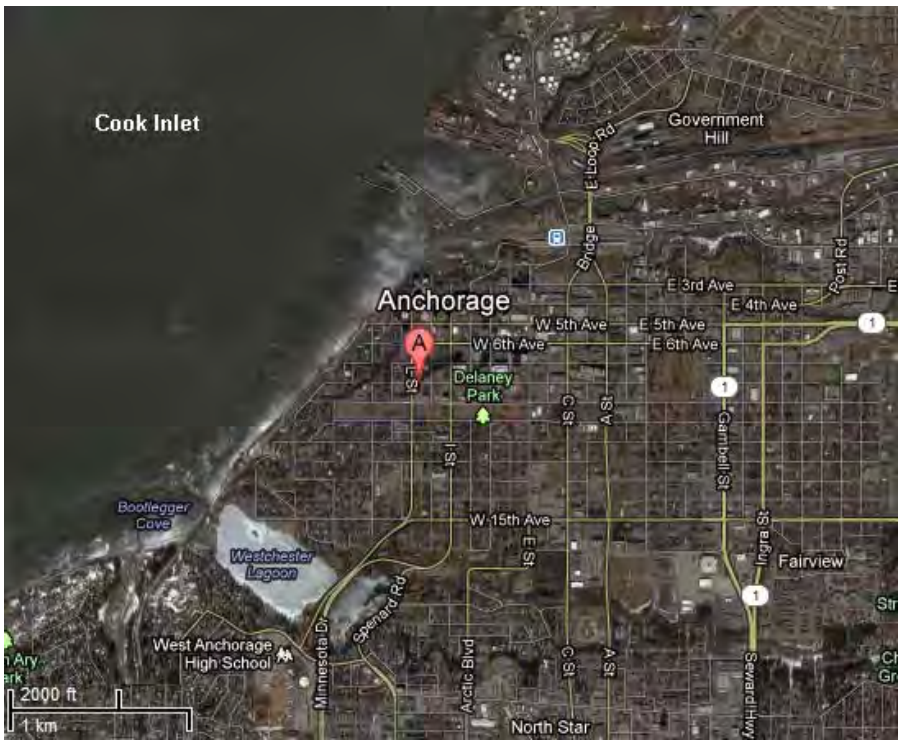


Figure 7. Urbanized areas surrounding the DHHS site in downtown Anchorage. The DHHS site (shown as callout A) in downtown Anchorage has extensive urbanized areas to the south and east. Urban development to the north and west is less extensive because of Cook Inlet.



Google Maps 2012

Table 2. Comparison of daily maximum wind gust speed and direction at PANC to PM_{10} concentration (24-hr average) in Eagle River (Parkgate) and Anchorage (1998-2010).

(A) Winds from the North

(Days with a lack of snow cover and precipitation are highlighted in yellow. ND = no data)

Date	Max gust (mph)	Wind Direction (degrees)	Max Anchorage PM-10 (ug/m3)	Parkgate PM-10 (ug/m^3)	Anchorage Snow Depth (in.)	Palmer Snow Depth (in.)	Total Precipitation (in.)	
							Day of	Day Prior
1/29/1999	37	360	43	ND	7	ND	0.00	0.00
3/6/2003	39	50	138	ND	0	ND	0.00	0.00
3/12/2003	57	20	421	590	0	ND	0.00	0.00
3/13/2003	67	30	180	ND	0	ND	0.00	0.00
1/6/2004	40	40	38	ND	24	15	0.00	0.00
3/18/2004	41	350	46	ND	25	28	0.00	0.00
3/22/2005	37	20	70	ND	1	0	0.01	0.00
3/14/2006	44	10	71	ND	12	ND	0.00	0.00
11/13/2006	36	360	ND	65	4	2	0.00	0.01
11/15/2006	41	340	66	ND	4	0	0.00	0.00
2/21/2007	37	360	13	ND	17	8	0.00	0.00
3/1/2007	51	20	56	28	17	7	0.00	0.00
3/13/2007	40	350	23	29	17	7	0.00	0.00
12/2/2007	47	40	99	223	T	0	0.00	0.00
12/8/2008	37	350	22	16	T	7	0.00	0.09
2/20/2009	36	350	7	7	9	3	0.00	0.06
2/21/2009	40	360	11	9	9	2	0.00	0.00
10/30/2009	36	40	123	163	0	0	0.00	0.00
10/31/2009	41	30	147	137	0	0	0.00	0.00
9/24/2010	52	30	180	208	0	0	0.00	0.00
11/3/2010	41	20	11	6	T	0	0.00	0.39
11/16/2010	37	350	65	14	5	3	0.00	0.01
11/29/2010	40	350	11	10	8	0	0.00	0.05
12/14/2010	41	340	23	8	8	ND	0.02	0.00
12/15/2010	41	360	29	14	8	ND	0.00	0.02

This table excludes 10 days when no PM_{10} data were available from any site in Anchorage or Eagle River.

(B) Winds from the South

(Days with a lack of snow cover and precipitation are highlighted in yellow. ND = no data)

Date	Max Gust (mph)	Wind Direction (degrees)	Max Anchorage PM-10 (ug/m^3)	Parkgate PM-10 (ug/m^3)	Anchorage Snow Depth (in.)	Palmer Snow Depth (in.)	Total Preciptation (inches)	
							Day of	Day Prior
4/27/1998	40	140	63	ND	0	0	0.00	0.00
8/16/1998	40	150	20	ND	0	ND	0.18	0.01
1/22/1999	46	140	32	ND	9	ND	0.00	0.00
1/23/1999	43	170	7	ND	9	ND	0.09	0.00
9/17/1999	40	140	36	ND	0	ND	0.09	0.00
12/22/1999	44	160	13	ND	14	ND	0.05	0.63
12/26/1999	39	160	8	7	5	ND	0.01	0.09
9/21/2000	44	150	40	19	0	ND	0.62	0.11
4/3/2001	41	160	21	ND	0	ND	0.23	0.00
1/10/2002	41	150	14	ND	17	ND	0.00	0.04
11/26/2002	43	140	42	ND	0	ND	0.00	0.00
11/27/2004	41	150	15	ND	2	ND	0.02	0.11
1/4/2005	39	160	8	3	4	0	0.42	0.06
4/22/2005	51	170	31	10	0	0	0.01	0.00
9/9/2005	41	140	10	ND	0	0	0.55	0.00
10/7/2006	45	160	6	ND	0	0	0.00	0.00
1/30/2007	47	150	14	9	18	16	0.00	0.00
2/20/2008	45	150	12	ND	13	0	0.00	0.18
1/15/2009	46	150	3	4	10	0	0.01	0.28
7/27/2009	39	150	11	12	0	0	0.15	0.02
11/11/2009	47	150	8	24	2	5	0.09	0.00
12/1/2009	39	150	8	2	6	4	0.02	0.04
5/19/2010	43	170	28	29	0	0	0.00	0.00
7/8/2010	39	160	13	13	0	0	0.03	0.01
8/16/2010	39	150	11	8	0	0	0.07	0.00

Thus, it is reasonable to conclude that the exceedances at Parkgate and DHHS stations were associated with the strong Matanuska Wind and not with anthropogenic activities in Eagle River or Anchorage. In the following section, we will demonstrate a clear, causal relationship between the wind events and the exceedances.

B. Clear causal relationship

In the winter of 2010-2011, the snow cover in the Palmer area needed to prevent wind-blown dust was not present until the end of November (Figure 8). This snow-free condition allowed the Matanuska Wind of September 24th to stir-up loose silt deposits in the glacial outwash and generate a large dust cloud, which was subsequently transported to downwind locations.

Figure 8. (A) Snow depth recorded in Palmer, AK between September 15th and November 30th, 2010.

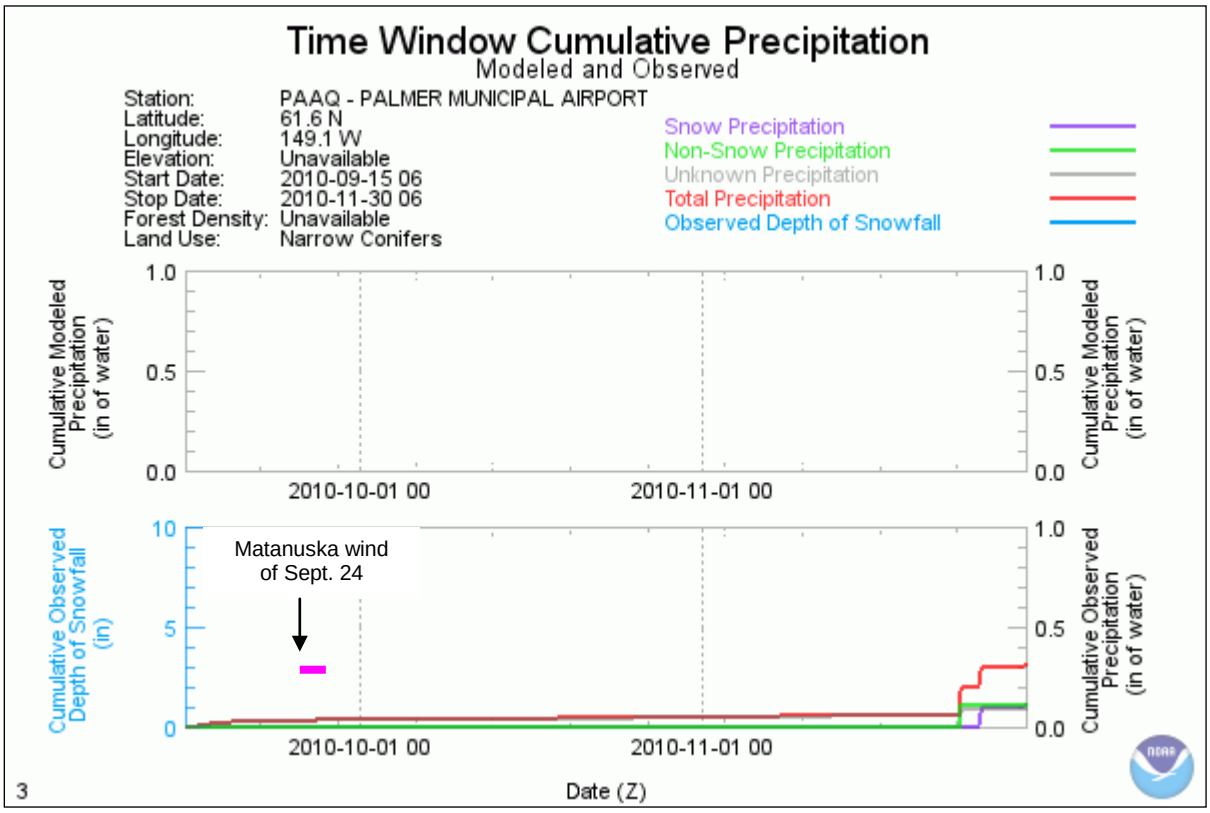
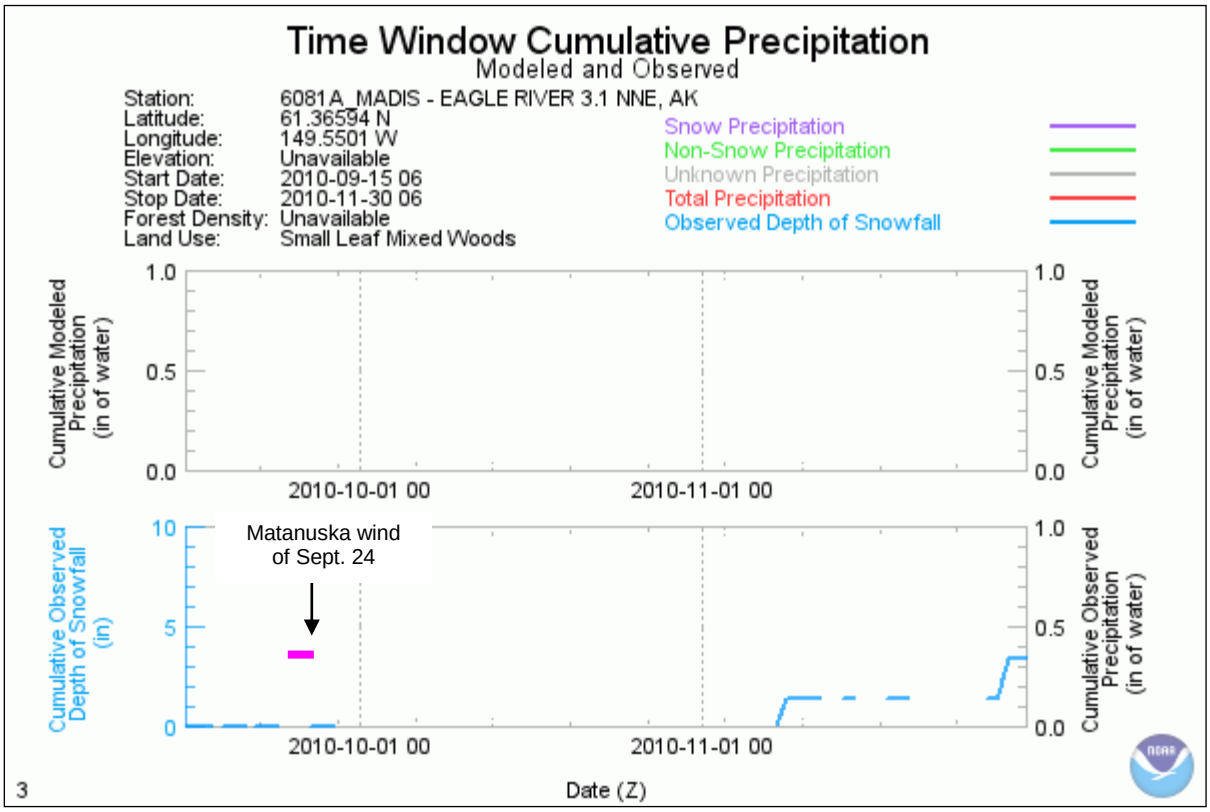


Figure 8. (B) Snow depth recorded in Eagle River between September 15th and November 30th, 2010.



(Source: NOAA National Operational Hydrologic Remote Sensing Center www.nohrsc.noaa.gov)

We analyzed the relationship between hourly PM_{10} concentration and wind speed and wind direction on September 24th for Palmer, Eagle River, and Anchorage to determine whether there was a clear causal relationship between high winds and the PM_{10} concentrations measured during the Matanuska Wind storm of September 24th. The climate data, obtained from Quality Controlled Local Climatological Data by NCDC (Appendix C), at Palmer Airport (PAAQ), Birchwood Airport (PABV), and Ted Stevens International Airport (PANC) were used for the analysis, and the data were. Wind speed observations were taken at the PANC and PAAQ airports using the Automated Surface Observation System (ASOS), a joint effort of the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense (DOD). The ASOS determines wind speed by averaging the speed over a 2-minute period. The average is updated once every five seconds and reported to the system once per minute[12]. The data at these two airports are generally reported once per hour unless weather conditions change rapidly and then reporting is more frequent. PABV uses the Automated Weather Observation System (AWOS) which is a system that pre-dates ASOS and is controlled solely by the FAA. AWOS updates wind speed every five seconds and calculates both a running two minute average and a ten minute average[13,14]. The AWOS generally reports at 20-minute intervals and does not account for changing

[12] National Oceanic and Atmospheric Administration, Department of Defense, Federal Aviation Administration, United States Navy, Automated Surface Observing System User's Guide, March, 1998.
[13] Eric Holloway, National Weather Service, Anchorage, Alaska, personal communication, December 19th, 2012.
[14] Coastal Environmental Systems, Inc., Operation and Maintenance Manual for Automated Weather Observation System (AWOS), June 18, 2010.

weather conditions[15]. PM_{10} data used in the analysis were from the Palmer, Parkgate, and DHHS sampling stations.

Figures 9A, 9B, and 9C comprise three sets of graphs – one set for each of the Palmer, Eagle River, and Anchorage areas. Each set includes graphs of wind speed, wind direction, and PM_{10} concentrations. Figure 9A shows the progression of the wind speed and PM_{10} concentrations in the Palmer area The high winds first began in Palmer at approximately 6pm on September 23rd with an average wind speed of 18 miles per hour (mph). The wind peaked in Palmer at approximately 1 pm on September 24th with a speed of 43 mph. Approximately three hours after the first high winds hit Palmer, a significant increase in wind speed was recorded at the Birchwood Airport at approximately 9 pm on September 23rd with a wind speed of 17 mph (Figure 9B). The winds at the Birchwood airport peaked at approximately 12:30 am on September 24th with a speed of 26 mph and then peaked again at 5pm on the same day with a speed of 25 mph. These high winds were sustained through 9 pm on September 24th and did not begin to decrease significantly until the early morning hours of September 25th. The winds in Anchorage began to increase at 1 am on September 24th with a speed of 15 mph (Figure 9C). The winds peaked at 3 pm on September 24th with a speed of 36 mph.

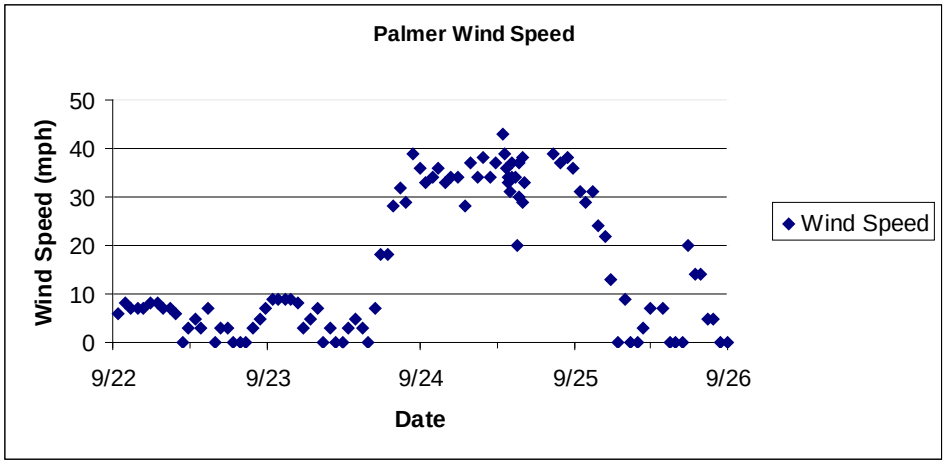
At all three locations, the high winds were north winds. Figure 9D illustrates the winds in all three locations on one plot. Wind data can be found in Appendix C.Figure 9D illustrates the progression of PM_{10} throughout the monitoring stations. The first peak PM_{10} concentrations were recorded at the Parkgate and DHHS stations at 12 am on September 24th with concentrations of and 383 $\mu g/m^3$ respectively. It is impossible to know if the Palmer station was also recording high PM_{10} values at this time since it was not operating from 12 pm on September 22nd to 2 am on September 24th. Parkgate station recorded its next peak concentration at 10 am on September 24th of 431 $\mu g/m^3$. The second peak concentration in Anchorage occurred at 12:00 pm, 2 hours after Parkgate, and was also 431 $\mu g/m^3$. The Palmer station recorded a PM_{10} peak concentration of 336 $\mu g/m^3$ at 4 pm on September 24th.

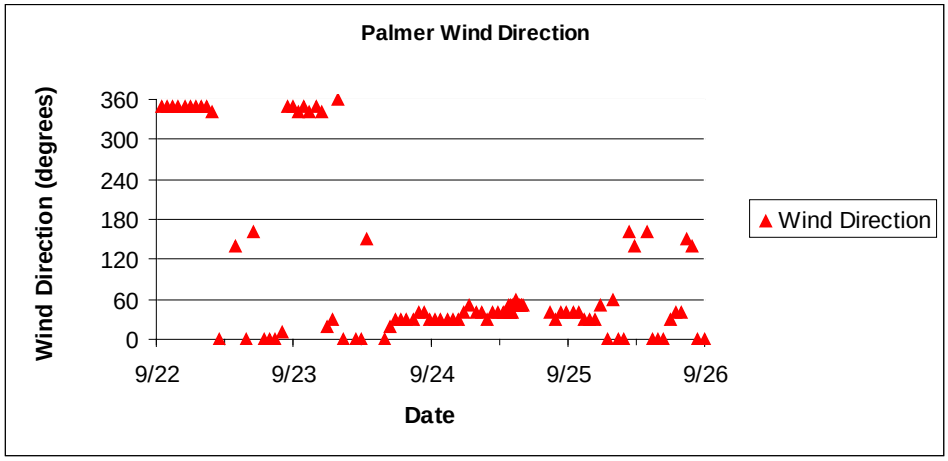
Interestingly, the temporal PM_{10} concentration pattern at the Parkgate and DHHS stations does not support the idea of a "PM_{10} front" that impacted the monitoring sites closest to the PM_{10} source and sites further south first and downwind later. (Figure 9D and Appendix C). The Palmer station was not in operation at the beginning of the wind storm so the precise arrival of the PM_{10} front at that location is unknown. However, the DHHS monitoring station recorded its first significant increase in PM_{10} three hours before the Parkgate station even though it is approximately 25 km south and downwind. Other monitoring stations in Anchorage (Tudor and Garden stations) also recorded their first significant increases in PM_{10} prior to Parkgate (see Appendix C for data). The satellite photo of the relatively narrow-streamed dust plume suggests the possibility of a meandering plume that could temporarily "miss" Eagle River on its way to Anchorage. This may explain why the dust plume affected Anchorage before Eagle River. Regardless of the precise order of the high concentrations of PM_{10}, the wind and PM_{10} data strongly indicate that the high winds directly affected PM_{10} concentrations at all monitoring stations.

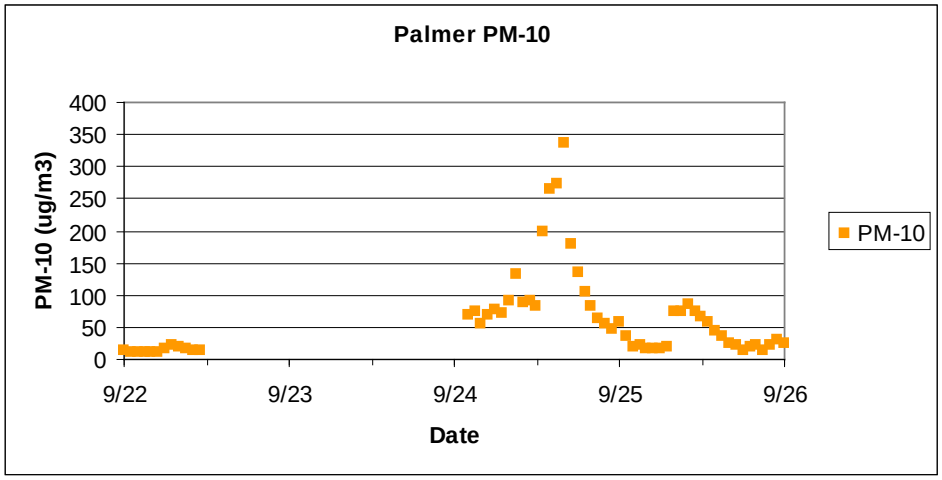
[15] Wikipedia, The Free Encyclopedia, Automated airport weather station, http://en.wikipedia.org/wiki/Automated_airport_weather_station

Figures 9 (A-C). Wind and PM_{10} during the wind storm in September 2010

Figure 9(A). Weather data = Palmer Airport (PAAQ); PM_{10} data = Palmer station.

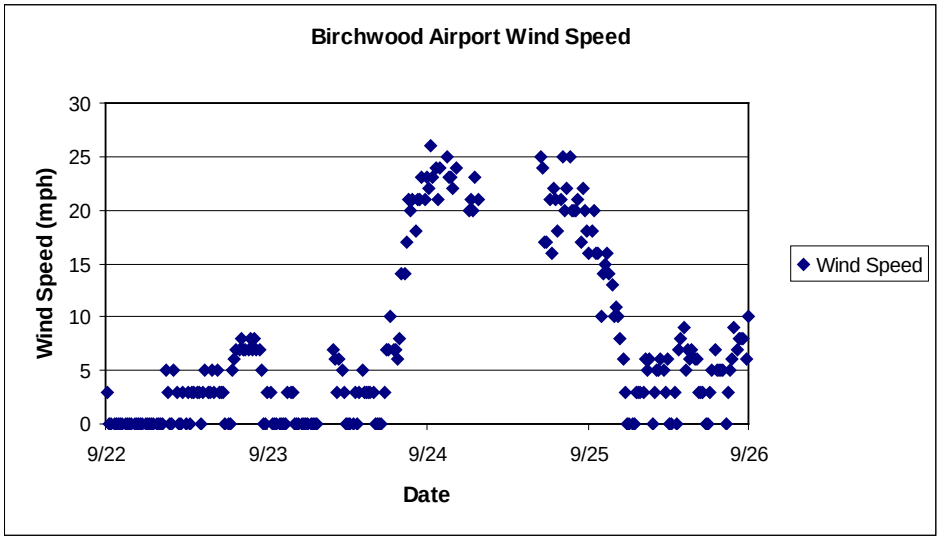


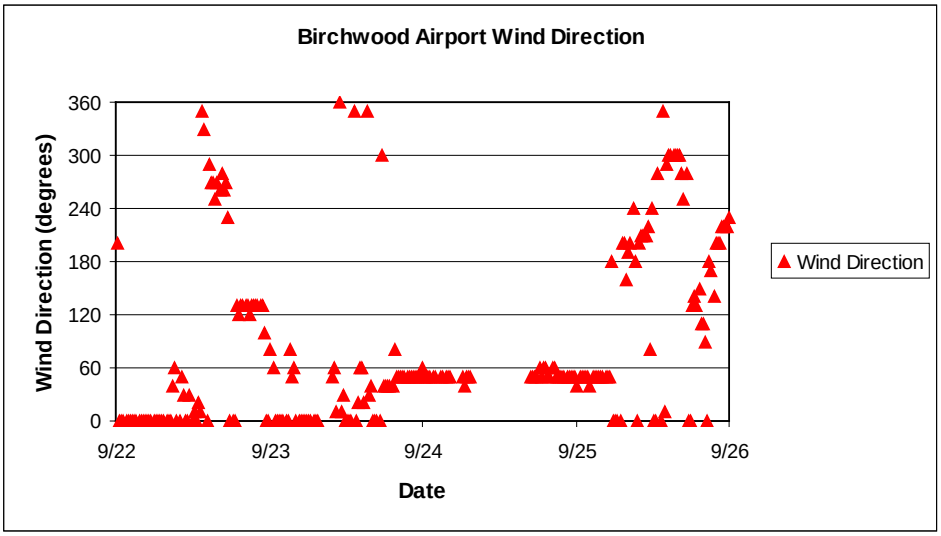




Note: The Palmer monitoring station was not collecting data on September 23rd, 2010

Figure 9(B). Weather data = Birchwood Airport (PABV); PM_{10} data = Parkgate station





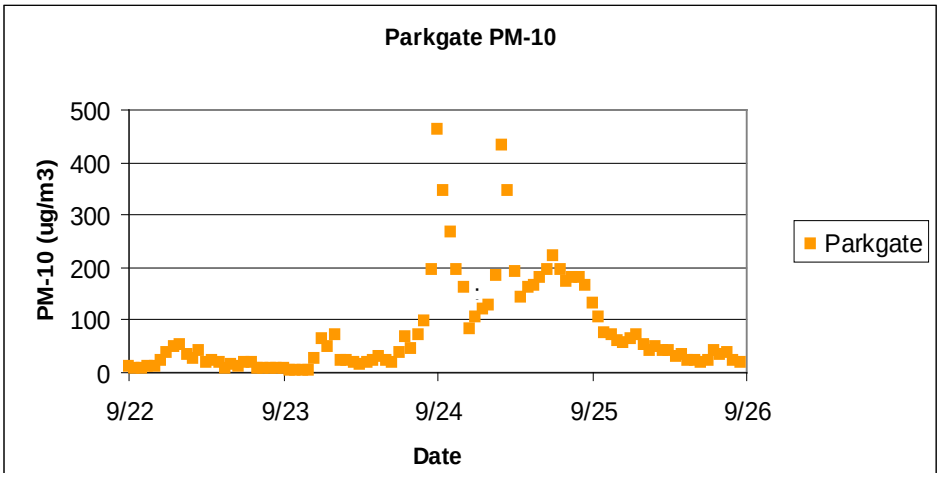
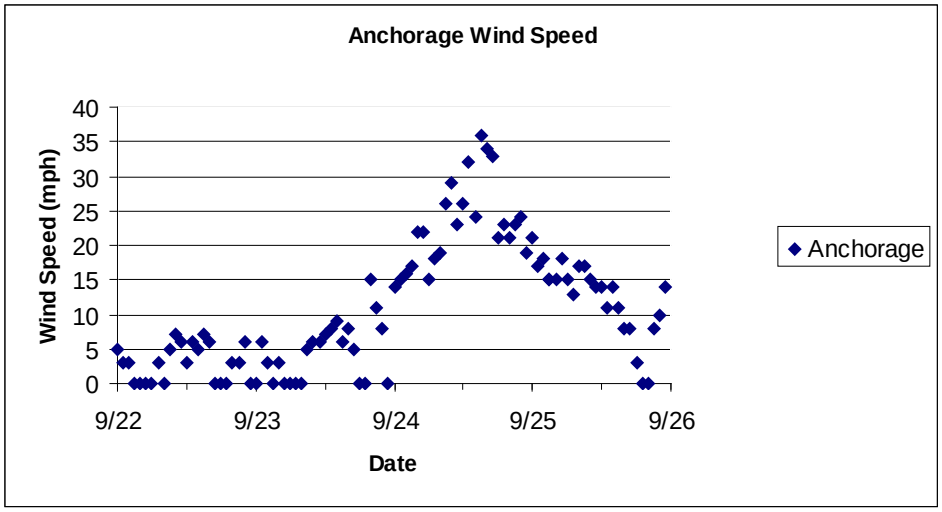
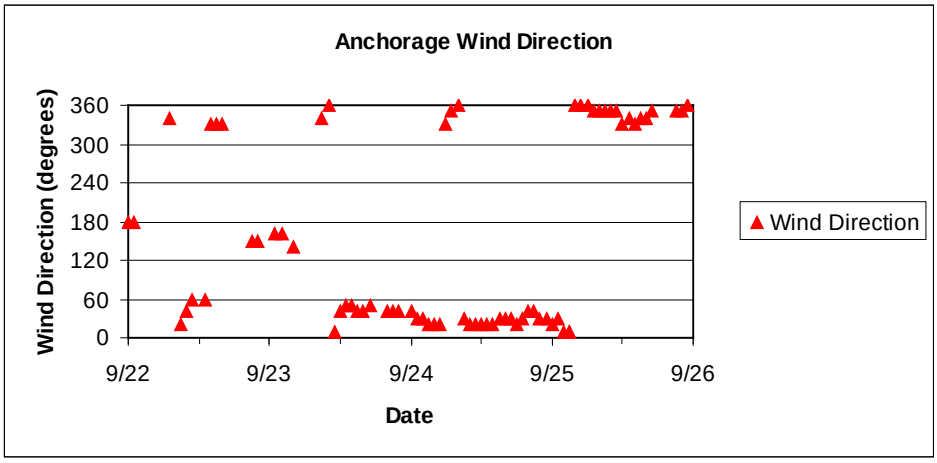


Figure 9(C). Weather data = Ted Stevens Anchorage International Airport (PANC).
PM_{10} data = DHHS station, downtown Anchorage





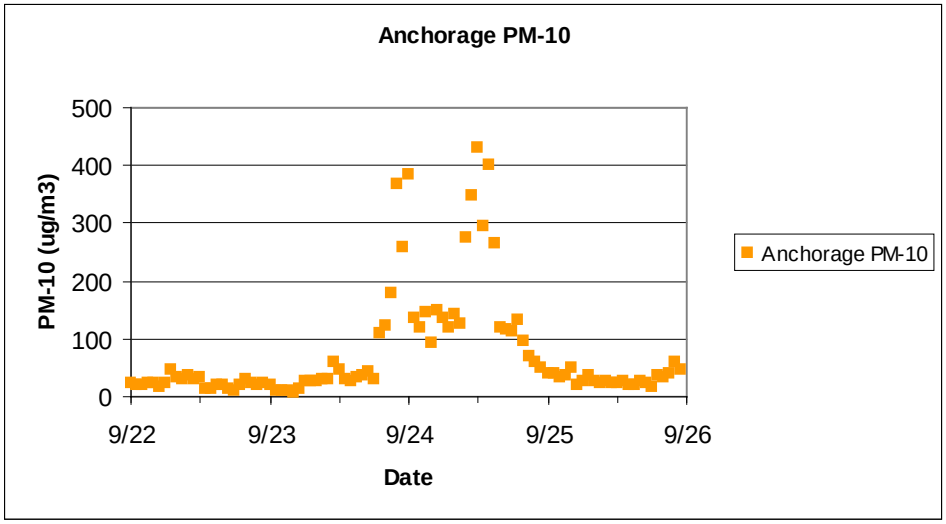
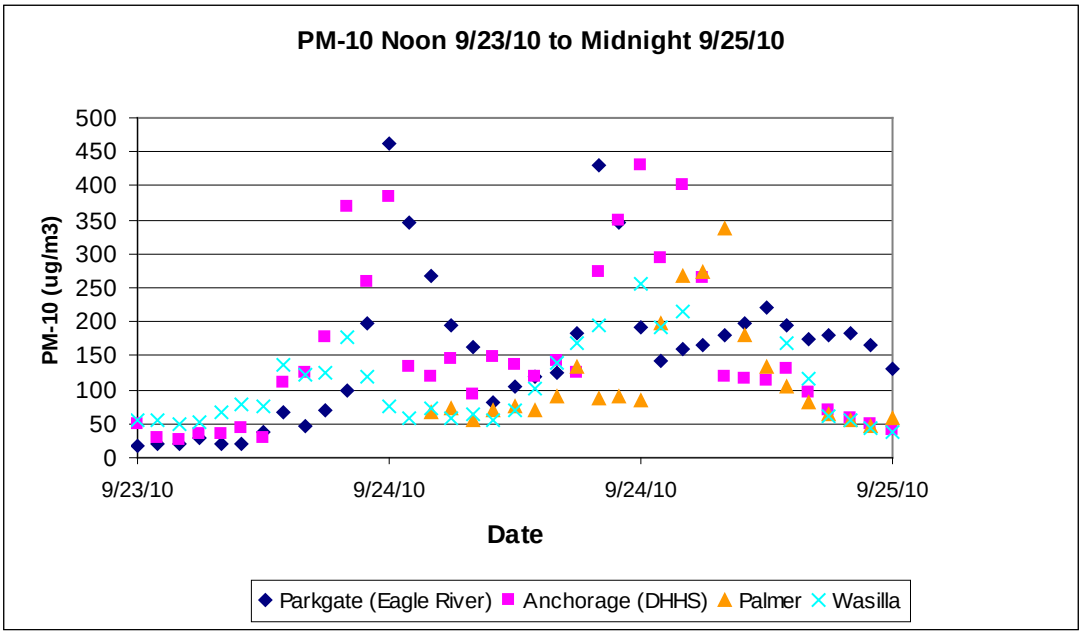
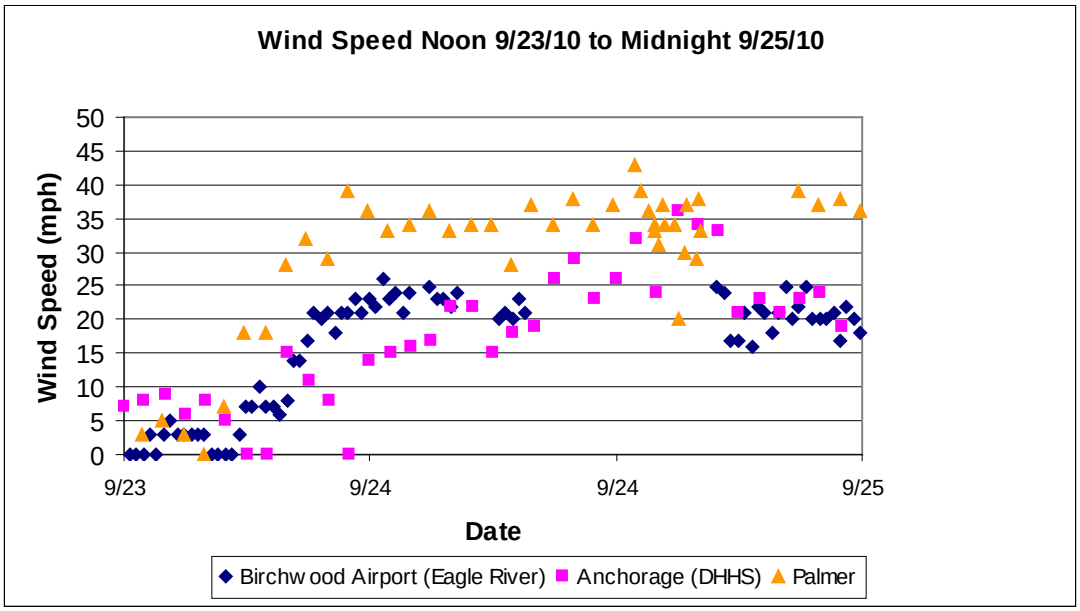


Figure 9(D). PM_{10} and wind speed in Anchorage, Eagle River, Palmer and Wasilla†

† Validated Wasilla data is not available in AQS and is presented here only for temportal consideration.





C. PM_{10} concentrations exceeded normal historical fluctuations

The 24-hr PM_{10} average concentration of 208 $\mu g/m^3$ at Parkgate and 180 $\mu g/m^3$ at DHHS observed on September 24th, 2010 are unusual for both stations. Including the event on September 24th, 2010, PM_{10} concentrations at either station have exceeded the NAAQS only four times in the 18 year period between 1993 and 2010[16]. All of these events have occurred when strong Matanuska winds coincided with snowless conditions. Exceptional events requests have been prepared for all

[16] We began our analysis with data beginning in 1993 because PM_{10} concentrations in prior years were heavily influenced by volcanic eruptions of Mt. Spurr (1992), and Mt. Redoubt (1990).

of these previous exceedances. EPA concurrence has been granted for two and the other is pending (Table 3).

Table 3. Annual top three PM_{10} concentrations at Parkgate and DHHS stations with and without the high wind events (1993- 2010). Bold numbers show the exceedance events.

(A) Parkgate Site (AQS ID: 02-020-1004)

Year	Sampling Frequency	Monitor POC	PM_{10} ($\mu g/m^3$) [AQS parameter: 81102] Without high values caused by high wind			With high values caused by high wind		Max gust* (mile/hr)	Exceptional Events status
			Max	2nd Max	3rd Max	Max	2nd Max		
1993	1 in 6	1	79	77	76	-	-		
1994	1 in 6	1	94	60	44	-	-		
1995	1 in 6	1	60	51	47	-	-		
1996	1 in 6	1	91	49	45	-	-		
1997	1 in 6	1	61	59	58	-	-		
1998	1 in 6	1	59	55	47	-	-		
1999	1 in 6	1	90	66	38	-	-		
2000	1 in 6	1	64	53	52	-	-		
2001	1 in 6	1	69	66	64	-	-		
2002	1 in 6	1	46	40	38	-	-		
2003	1 in 6	1	92	75	70	**590**	-	57	Concurrence
2004	1 in 6	1	70	43	38	-	-		
2005	1 in 6	1	90	65	51	-	-		
2006	1 in 6	1	65	60	48	-	-		
2007	1 in 6	1	48	46	39	**223**	-	47	Pending concurrence
2008	1 in 6	1	70	53	47	**-**	-		
2009	daily	3	78	74	73	**163**	137	41	Concurrence
2010	daily	3	93	72	65	**208**	-	52	Requested

*The gust data are recorded at PANC (source: NCDC)

(B) DHHS Station (AQS ID: 02-020-0052) The DHHS station began collecting data in 2009.

Year	Sampling Frequency	Monitor POC	Without high values caused by high wind			With high values caused by high wind		Max gust* (mile/hr)	Exceptional Events status
			Max	2nd Max	3rd Max	Max	2nd Max		
2009	daily	3	82	71	62	147	121	41	
2010	daily	3	89	65	51	**180**	-	52	Requested

In Figure 10, the highest three PM_{10} concentrations at Parkgate station that have not been flagged as exceptional events are plotted for the 1993 through 2010 period, along with four flagged exceptional events regardless of status (concurrence, pending, and requested). From the graph it is clear that the PM_{10} values observed on September 24th, 2010, along with three earlier exceptional events, are completely outside of the normal variability of the highest PM_{10} concentrations observed at Parkgate station. Furthermore, when the exceptional event data points are excluded, the trend of maximum PM_{10} values in Eagle River has remained stable over the past 17 years.

Figure 10. Normal variability of high PM_{10} vs. wind-caused high PM_{10} events at Parkgate station. The three highest PM_{10} concentrations for the period 1993-2010 are plotted along with the exceptional events of all status (concurrence, pending, and requested).

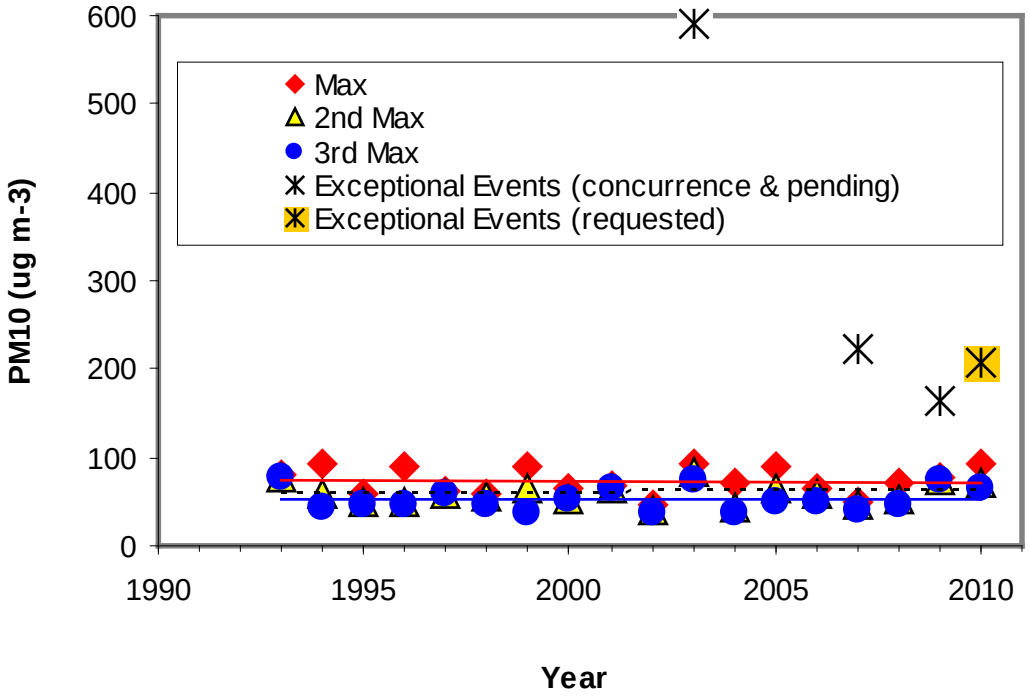


Figure 11(A) shows a frequency distribution of 24-hour average PM_{10} concentrations at the Parkgate station during the period 1993-2010. The plotted distribution shows all data including exceptional events regardless of their EPA concurrence status (i.e., concurrence, concurrence pending, or requested). The figure indicates that 96% of the observed PM_{10} values are less than 50 $\mu g/m^3$ and 99.7% are below 100 $\mu g/m^3$. Only 0.2% of all observations have exceeded the NAAQS. All of these have been associated with Matanuska Wind events.

In Figure 11(B), a frequency distribution of all 24-hour concentrations at the DHHS station since 2009 is shown (the DHHS station has only been in operation since 2009). The figure indicates that 98% of the observed PM_{10} values are less than 50 $\mu g/m^3$ and 99.6% are below 100 $\mu g/m^3$. Only one observation, the September 24, 2010 Matanuska Wind event, has exceeded the NAAQS.

Figure 11. (A) Frequency distribution of Parkgate PM_{10} concentrations 1993-2010.

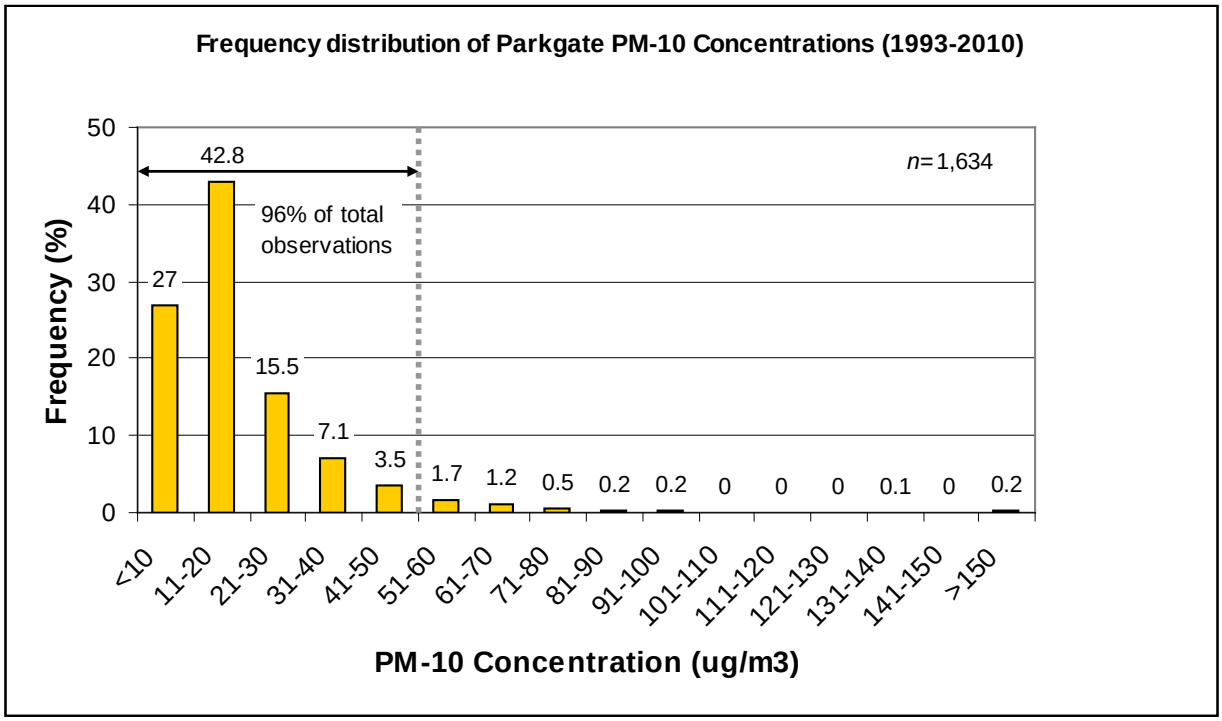
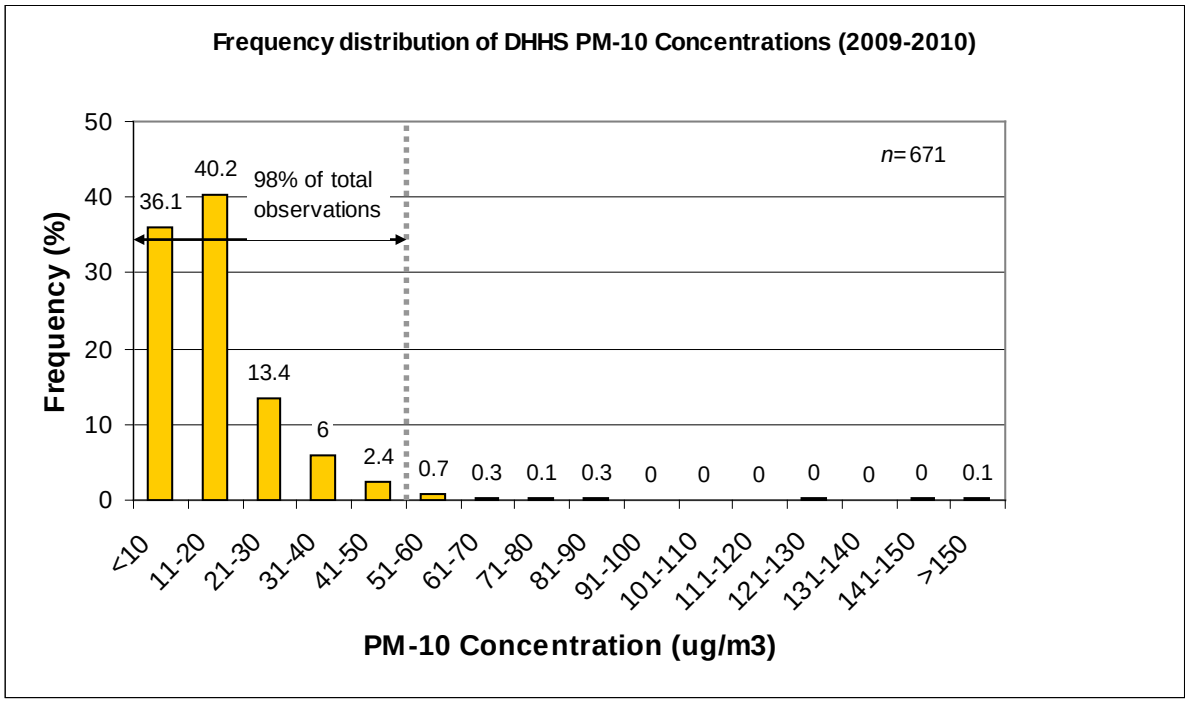


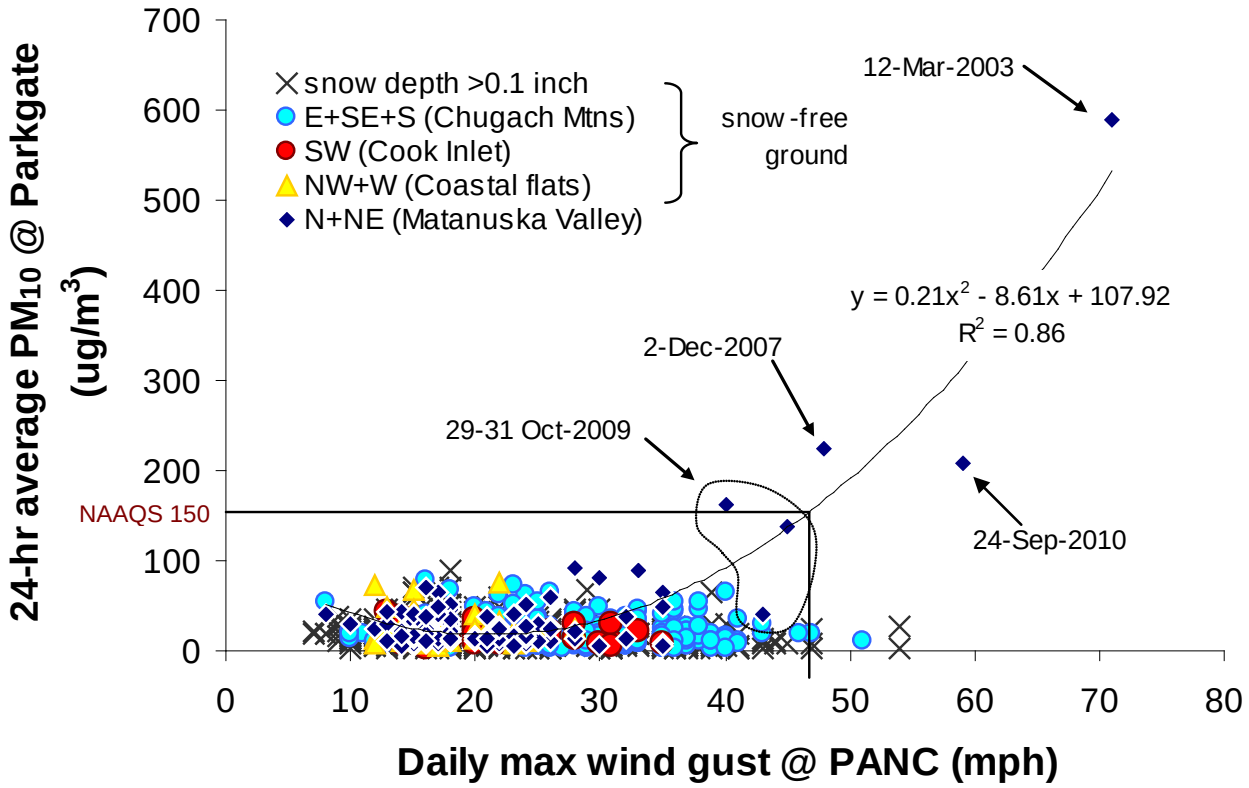
Figure 11. (B) Frequency distribution of DHHS PM_{10} Concentrations (2009-2010).



D. There would have been no exceedance but for the event

Analysis of historical data reveals a close association between PM_{10} concentrations and weather conditions. In Figure 12, all 24-hr PM_{10} average concentrations recorded at Parkgate station during the period of 1998 through 2010 are plotted against the daily maximum gust speed observed at PANC[17]. PM_{10} values measured when snow cover was present are noted with crosses; values when snow cover was not present are noted with other symbols. These other symbols indicate the wind direction and geographic characteristics of the upwind location when the PM_{10} sample was collected. For example, a red circle indicates that the PM_{10} measurement was made on a day with no snow cover when southwest winds blew over Cook Inlet before reaching Eagle River. Because Cook Inlet is likely to contribute little to PM_{10} emissions, on those days with red circles, the contribution of natural sources of PM_{10} in Eagle River was minimal. PM_{10} concentrations above 100 µg/m^3 were observed only when N-NE winds of ≥40 mph blew over snow-free ground.

Figure 12. Relationship between PM_{10} concentrations at Parkgate station and daily maximum wind gust speeds at PANC with and without snow cover on the ground (1998-2010).



A regression model for N-NE gust speed and PM_{10} concentration explains most variability of PM_{10} observed at the Parkgate station (R^2=0.86). According to this model, when there is no snow cover, an exceedance of the PM_{10} NAAQS can be expected at the Parkgate station whenever the maximum wind gust speed at PANC exceeds 46 mph. Based on this model, it is reasonable to predict that under snow-free conditions the PM_{10} concentration at Parkgate station is at risk of exceeding the NAAQS whenever Matanuska Wind gusts speeds reach 40-50 mph (measured at PANC).

We conclude that 'but for' the unusually strong northerly Matanuska Wind (greater than or equal to 40 mph at PANC) that blew over snow-free ground, there would have been no exceedance of the 24-Hour average PM_{10} NAAQS. Without these winds, we are confident that PM_{10} 24-hour average concentration values would have remained well below 100 µg/m^3 on September 24th, 2010.

[17] Complete weather data (from NCDC) that include snow depth on the ground was available only at PANC.

E. Procedural requirements

Exceptional Events Rule requirements: 40 CFR §50.14(c)(2)(iii)

In accordance with the Exceptional Events rule 40 CFR §50.14(c)(2)(iii), both data points (Parkgate and DHHS) from September 24th, 2010 were flagged as high wind, exceptional events prior to July 2011. We are requesting that EPA exclude both of these data points in determining whether the Parkgate and DHHS sites are in compliance with the NAAQS or assessing whether Eagle River will continue to qualify as a limited maintenance area.

Implementation of the Natural Events Action Plan (NEAP)

Anchorage prepared a NEAP for wind blown dust events in 2002. Two required elements of the NEAP are to:

1. Establish public notification and education programs.
2. Minimize public exposure to high concentrations of PM_{10} due to future natural events.

The Alaska Air Monitoring Network, a regional network which includes Anchorage, Eagle River, and the Matanuska-Susitna Valley, has allowed access to "real-time" air quality data, including PM_{10} since 2009. This network system has made it possible to assess the extent of wind-blown dust and to predict whether PM_{10} levels in Eagle River and Anchorage might approach or exceed the NAAQS. During the event on September 24th, 2010, MOA successfully assessed the conditions and notified the public of a potential exceedance and recommended actions to be taken to minimize exposure (Appendix B).

F. Conclusion

As presented above, the exceedances at the Parkgate and DHHS monitoring stations on September 24th, 2010 were beyond the normal fluctuation of PM_{10} concentrations at both stations. The high PM_{10} occurred only when the strong north Matanuska Wind was blowing over snow-free ground. It is clear that there would not have been exceedances on September 24th if not for the wind storm. Moreover, there would have been no exceedance had the floodplain been covered with substantial snow prior to the onset of the wind storm. Neither wind nor snow cover is controllable or directly affected by human activities. Therefore, the exceedance and high PM_{10} concentrations of September 24th, 2010 were caused by an uncontrollable and unpreventable natural event.

Because wind-blown dust is one of the major natural soil forming processes around Palmer and the lower Matanuska Valley area, dust entrainment by high winds in this area is inevitable. Our model suggests that if no snow cover is present when Matanuska Wind gust speeds (measured at PANC) exceed 40-50 mph, an exceedance is likely. The probability of future exceedances caused by high winds is difficult to determine because the timing of Matanuska Wind storms and the arrival of "preventative" snow cover differ each year. Warmer climate has affected many western states, prolonging snow-free seasons. For example, snowmelt was observed 1-3 weeks earlier in 2000 than in 1948 for most snow-fed western rivers.[18] A long-term trend of snowmelt timing in western U.S., measured as the amount of snow remaining on the ground on April 1st, shows that there is, on average, less snow on the ground on that date than there was 50 years ago[19]. While later establishment of snow cover in late fall and earlier snowmelt in early spring in the Matanuska Valley and its floodplain would mean greater chances of the Matanuska Wind blowing over dry and snow-free ground and an increased probability of PM_{10} exceedances at the Parkgate and Anchorage monitoring stations, it is unknown whether this same trend in reduced snow cover observed in the Western U.S. is also occurring on the flood plain of the Matanuska River.

[18] Stewart et al. (2004) Changes in snowmelt runoff timing in western North America under a 'business as usual'. climate change scenario. *Climatic Change* **62:** 217–232.

[19] Hamlet et al. (2005) Effects of temperature and precipitation variability on snowpack trends in the Western United States. *J. Climate* **18**:4545-4561.

Appendix A

Local News Reports by Anchorage Daily News and Mat-Su Frontiersman
&
Local weather forecast by NWS on September 24th, 2010

Source: http://www.adn.com/2010/09/24/1470087/high-winds-cut-power-in-anchorage.html#ixzz10V1urQIM

High winds cut power in Anchorage, Valley

By CASEY GROVE
casey.grove@adn.com

Published: September 24th, 2010 04:48 PM
Last Modified: September 24th, 2010 04:49 PM

Widespread power outages hit the Matanuska Valley and Anchorage Bowl today as high winds swept into Southcentral Alaska and knocked trees into power lines. Thousands of homes and businesses were without power, and crews for area power utilities were scrambling from one location to another trying to get substations working again and downed trees off of power lines. Power lines were also reported falling into streets and yards.

The high wind is expected to continue into the night, according to the National Weather Service.

About 10,000 Chugach Electric customers in various locations around Anchorage were without power at 4 p.m., company spokeswoman Patti Bogan said. Those included customers in Turnagain, the Raspberry-Jewel Lake area, Spenard, Woodland Park, DeBarr Road and East Anchorage, and the Campbell Lake area, she said. Tyonek and Granite Point, across Cook Inlet from Anchorage, were also without power, Bogan said.

Chugach crews would be busy restoring electricity until all customers were back online, Bogan said.

As many as 10,000 homes and businesses from Eagle River to Talkeetna lost power overnight, a spokeswoman for Matanuska Electric Association said. About 2,000 MEA customers were still experiencing outages as of 3 p.m.

It is uncertain when power will be back for those customers, MEA's Cheryll Heinze said. Crews had been scrambling from one location to another since early morning, some of which had been working for 12 hours straight, MEA General Manager Joe Griffith said.

"I think we're holding our own on it right now," Griffith, a veteran of Alaska electrical utilities, said. If necessary, MEA could call in additional crews from other utilities, he said.

Griffith is keeping a close eye on worker fatigue and safety, as wind gusts make working in man-lifts difficult.

"If they call in and say, 'Hey boss, it's blowing too hard out here to do this,' then we say hunker down and wait."

Customers are asked to report any outages, which helps locate problem areas, and not to cut down trees that might be touching power lines.

Valley residents continue to watch the wind, which seemed to pick up again mid-afternoon and shift directions, Heinze said.

"Then the trees blow the other way," she said. "So it looks like it's going to be a long night, again."

Meanwhile, in Anchorage, scattered outages were swamping Municipal Light & Power across their entire service area, and Chugach's outages expanded from dozens to thousands.

Anchorage police reported traffic lights at intersections across the city were knocked out for a time, but were working again by mid-afternoon.

"Of course, when the wind keeps blowing and trees keep hitting transmission lines, it's hard to predict where the next outage will be," ML&P spokeswoman MaryAnn Hanson said.

Hanson said the continuing wind made it difficult to know when power would be restored.

The National Weather Service has issued a high-wind warning for the Mat-Su Valley, in effect until 4 a.m., due to sustained 35 to 50 mph wind with gusts up to 75 mph.

The weather service reported in a midafternoon statement that the highest wind gust reported up to that time in Anchorage was 46 mph at Anchorage International Airport, though gusts exceeding 40 mph were reported at Elmendorf Air Force Base and Merrill Field. The strongest winds seemed to be in the west part of Anchorage, according to the service.

Gusts exceeding 50 mph were possible in East Anchorage, with the winds continuing into the evening, the service said.

The Anchorage Department of Health and Human Services issued a health advisory because of concentrations of airborne particulates in Eagle River and Anchorage. The department said in its statement that strong north winds were picking up dust from the Matanuska River drainage and bringing it into Anchorage.

"The Department of Health and Human Services advises those with heart and lung ailments, like asthma, bronchitis and emphysema to avoid dusty areas near major traffic thoroughfares if possible. Those with severe lung disease are advised to remain indoors," the department said in its statement.

The Matanuska-Susitna Borough also issued an air quality advisory, as the high winds had kicked up a great deal of dust.

"You look out the east, toward the Knik River, and you can't even see the mountains up there because of all the dirt in the air," MEA's Griffith said.
Read more: http://www.adn.com/2010/09/24/1470087/high-winds-cut-power-in-anchorage.html#ixzz10V1urQIM

Source: Mat-Su Valley Frontiersman Newspaper

(http://www.frontiersman.com/articles/2010/09/24/breaking_news/doc4c9cfa096955c860602585.txt)

High winds knock out power, force Parnell event to move inside

Published on *Friday, September 24, 2010 11:28 AM AKDT*

High winds that began last night have knocked out power to some Valley neighborhoods. Power has been out for as long as four hours.

Due to the winds, the location for today's noon to 1 p.m. meet and greet event and community picnic event with Governor Sean Parnell and U.S. Senate candidate Joe Miller has changed from Newcomb Park to the Menard Sports Complex.

The Mat-Su Borough also has issued an air quality advisory for the Palmer area from 9 a.m. Friday through 8 a.m. Monday. Due to increasing winds the air quality in the Palmer area may become unhealthy to hazardous.

Children, the elderly and persons with existing heart or lung disease should stay indoors and reduce physical activity. The general population should avoid vigorous outdoor activity.

Please call the 24-hour Air Quality Alert System phone number, 352-3878, for daily information on air quality in the eastern Matanuska valley. This advisory will expire at 8 a.m. Monday, or when the wind subsides, whichever is earlier, or to be updated if conditions change.

For more information, call the Mat-Su Borough Planning Division at 745-9833.

NWS Forecast Office – Anchorage, AK
Source: (http://pafc.arh.noaa.gov/fcst.php?zone=AKZ111)

Posted on 24 Sept 2010 (AM)

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FPAK51PAFC_AKZ111
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AKZ111-250000-
MATANUSKA VALLEY-
INCLUDING...PALMER...WASILLA...SUTTON...CHICKALOON
500 AM AKDT FRI SEP 24 2010

...STRONG WIND THROUGH TONIGHT...

.TODAY...MOSTLY SUNNY. AREAS OF BLOWING DUST. HIGHS IN THE UPPER 40S
TO MID 50S. NORTHEAST WIND 15 TO 30 MPH WITH GUSTS 40 TO 60 MPH.
.TONIGHT...PARTLY CLOUDY. AREAS OF BLOWING DUST. LOWS IN THE 30S.
NORTHEAST WIND 15 TO 30 MPH WITH GUSTS 45 MPH. HIGHER GUSTS TO 60 MPH
IN THE EVENING.
.SATURDAY...MOSTLY CLOUDY IN THE MORNING THEN BECOMING PARTLY
CLOUDY. HIGHS IN THE 50S. NORTHEAST WIND 15 TO 30 MPH.
.SATURDAY NIGHT...MOSTLY CLEAR. LOWS IN THE 30S. NORTHEAST WIND
10 TO 15 MPH.
.SUNDAY...MOSTLY SUNNY. HIGHS IN THE MID 40S TO LOWER 50S.
NORTHEAST WIND 10 TO 15 MPH.
.SUNDAY NIGHT...MOSTLY CLEAR. LOWS 25 TO 35.
.MONDAY AND MONDAY NIGHT...CLEAR. HIGHS IN THE 40S. LOWS IN THE
20S.
.TUESDAY...PARTLY CLOUDY. HIGHS 45 TO 55.
.TUESDAY NIGHT AND WEDNESDAY...MOSTLY CLOUDY. LOWS IN THE 30S.
HIGHS 45 TO 55.
.WEDNESDAY NIGHT AND THURSDAY...MOSTLY CLOUDY WITH A CHANCE OF
RAIN. LOWS 35 TO 45. HIGHS IN THE 40S.

&&
               TEMPERATURE     /    PRECIPITATION

PALMER       50     37     52  /   0      0      0
WASILLA      49     34     52  /   0      0      0


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AKZ111-251015-
/X.NEW.PAFC.HW.W.0011.100924T2114Z-100925T1200Z/
MATANUSKA VALLEY-
INCLUDING THE CITIES OF...PALMER...WASILLA...SUTTON...CHICKALOON
114 PM AKDT FRI SEP 24 2010

...HIGH WIND WARNING IN EFFECT UNTIL 4 AM AKDT SATURDAY ALONG THE
MATANUSKA VALLEY...

THE NATIONAL WEATHER SERVICE IN ANCHORAGE HAS ISSUED A HIGH WIND
WARNING...WHICH IS IN EFFECT UNTIL 4 AM AKDT SATURDAY.

NORTHEAST 35 TO 50 MPH WITH GUSTS TO 75 MPH WILL CONTINUE TO BLOW
OUT OF THE MATANUSKA VALLEY THROUGH TONIGHT AND GRADUALLY
DIMINISH EARLY SATURDAY MORNING.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

A HIGH WIND WARNING MEANS A HAZARDOUS HIGH WIND EVENT IS EXPECTED
OR OCCURRING. PEOPLE ARE URGED TO SECURE LOOSE OBJECTS THAT COULD
BE BLOWN AROUND OR DAMAGED BY THE WIND.

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Appendix B

Air Quality Advisories issued on September 24th, 2010 by Municipality of Anchorage and Matanuska-Susitna Borough

MUNICIPALITY OF ANCHORAGE

Department of Health and Human Services 907-343-6718

Mayor Dan Sullivan

For immediate release: September 24, 2010 **Contact: Allison Biastock 343-4619**

Municipality Issues Air Quality Advisory

The Anchorage Department of Health and Human Services has issued a health advisory because concentrations of airborne particulates in Eagle River and Anchorage are approaching unhealthful concentrations.

Strong north winds with gusts exceeding 40 mph are picking up dust from the Matanuska River drainage and transporting it southward to Anchorage. The Matanuska-Susitna Borough has also issued an air quality advisory for the Palmer area. Dusty conditions are expected to be highest in Eagle River, Chugiak, Peters Creek and Eklutna due to their proximity to the Matanuska Valley.

The National Weather Service is currently predicting windy conditions through Saturday morning.

The Department of Health and Human Services advises those with heart and lung ailments, like asthma, bronchitis and emphysema to avoid dusty areas near major traffic thoroughfares if possible. Those with severe lung disease are advised to remain indoors.

Air quality updates can be obtained by calling the Municipal Air Quality Hotline at 343-4899.

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MATANUSKA-SUSITNA BOROUGH

Planning and Land Use Department

Planning Division

350 East Dahlia Avenue • Palmer, AK 99645
Phone (907) 745-9833 • Fax (907) 745-9876
planning@matsugov.us

AIR QUALITY ADVISORY/PRESS RELEASE

The Matanuska-Susitna Borough is issuing an air quality advisory for the Matanuska Valley including the communities of Palmer, Wasilla, Sutton and Chickaloon, valid from 2:00 pm, Friday, September 24, 2010 through 8:00 am, Monday, September 27, 2010 or until the wind subsides. Due to increasing winds the air quality in the Matanuska Valley including the communities of Palmer, Wasilla, Sutton and Chickaloon, may become unhealthy to hazardous.

CHILDREN, THE ELDERLY, AND PERSONS WITH EXISTING HEART OR LUNG DISEASE SHOULD STAY INDOORS AND REDUCE PHYSICAL ACTIVITY. THE GENERAL POPULATION SHOULD AVOID VIGOROUS OUTDOOR ACTIVITY.

Please call the 24-hour Air Quality Alert System phone number, 352-3878, for daily information on air quality in the eastern Matanuska Valley. This advisory will expire at 8:00 am, Monday, September 27, 2010 or when the wind subsides, whichever is earlier, or be updated if conditions change.

If you have any questions, please call the Matanuska-Susitna Borough, Planning Division at 745-9833.

_____ _____

Eileen Probasco, Chief of Planning Date

Appendix C

PM_{10} and weather data around the wind storm

PM-10 Data Surrounding September 24th, 2010 Wind Event (September 22nd to 28th, 2010)

Source: EPA AQS database;

AQS Monitor IDs:

DHHS: 02-020-0052-81102-3 Parkgate: 02-020-1004-81102-3 Palmer: 02-170-0012-85101-3

Garden: 02-020-0018-81102-3 Tudor: 02-020-0044-81102-3

Date	Time	DHHS	Garden	Parkgate	Tudor	Palmer
		PM10	PM10	PM10	PM10	PM10
		ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
9/22/2010	12:00 AM	23	16	11	11	13
9/22/2010	1:00 AM	21	11	8	18	12
9/22/2010	2:00 AM	21	12	8	10	11
9/22/2010	3:00 AM	22	13	12	11	12
9/22/2010	4:00 AM	22	14	13	12	11
9/22/2010	5:00 AM	17	13	23	26	10
9/22/2010	6:00 AM	24	25	39	40	17
9/22/2010	7:00 AM	46	36	50	53	23
9/22/2010	8:00 AM	32	35	51	25	19
9/22/2010	9:00 AM	30	21	33	18	17
9/22/2010	10:00 AM	35	20	27	25	
9/22/2010	11:00 AM	31	17	43	18	
9/22/2010	12:00 PM	32	16	17	19	
9/22/2010	1:00 PM	14	8	22	19	
9/22/2010	2:00 PM	13	10	18	19	
9/22/2010	3:00 PM	21	16	9	17	
9/22/2010	4:00 PM	19	12	16	12	
9/22/2010	5:00 PM	13	10	13	13	
9/22/2010	6:00 PM	11	15	17	13	
9/22/2010	7:00 PM	19	28	18	27	
9/22/2010	8:00 PM	31	35	6	23	
9/22/2010	9:00 PM	22	31	7	17	
9/22/2010	10:00 PM	19	20	8	20	
9/22/2010	11:00 PM	22	8	8	20	
9/23/2010	12:00 AM	19	6	8	14	
9/23/2010	1:00 AM	11	7	5	12	
9/23/2010	2:00 AM	11	8	5	11	
9/23/2010	3:00 AM	10	6	4	12	
9/23/2010	4:00 AM	7	7	5	15	
9/23/2010	5:00 AM	14	14	28	56	
9/23/2010	6:00 AM	25	27	64	52	
9/23/2010	7:00 AM	26	46	50	71	
9/23/2010	8:00 AM	26	32	73	29	
9/23/2010	9:00 AM	29	30	21	14	
9/23/2010	10:00 AM	30	20	23	17	
9/23/2010	11:00 AM	60	23	17	21	
9/23/2010	12:00 PM	48	27	16	19	
9/23/2010	1:00 PM	30	22	20	30	
9/23/2010	2:00 PM	27	19	21	26	
9/23/2010	3:00 PM	34	13	29	20	

Date	Time	DHHS	Garden	Parkgate	Tudor	Palmer
		PM10	PM10	PM10	PM10	PM10
		ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
9/23/2010	4:00 PM	35	20	21	17	
9/23/2010	5:00 PM	43	25	20	25	
9/23/2010	6:00 PM	29	30	39	31	
9/23/2010	7:00 PM	110	60	67	30	
9/23/2010	8:00 PM	124	101	46	77	
9/23/2010	9:00 PM	178	88	71	65	
9/23/2010	10:00 PM	368	155	98	66	
9/23/2010	11:00 PM	259	254	197	66	
9/24/2010	12:00 AM	383	277	463	232	
9/24/2010	1:00 AM	135	201	345	232	
9/24/2010	2:00 AM	118	176	268	194	68
9/24/2010	3:00 AM	146	118	195	137	74
9/24/2010	4:00 AM	94	88	162	137	56
9/24/2010	5:00 AM	148	53	82	72	70
9/24/2010	6:00 AM	136	91	104	85	76
9/24/2010	7:00 AM	119	79	120	85	71
9/24/2010	8:00 AM	141	75	126	73	91
9/24/2010	9:00 AM	126	84	184	85	133
9/24/2010	10:00 AM	274	154	431	86	88
9/24/2010	11:00 AM	349	139	346	171	90
9/24/2010	12:00 PM	431	115	193	141	84
9/24/2010	1:00 PM	294	98	142	145	198
9/24/2010	2:00 PM	400	95	160	117	266
9/24/2010	3:00 PM	264	78	166	105	272
9/24/2010	4:00 PM	119	92	179	118	336
9/24/2010	5:00 PM	117	96	197	118	180
9/24/2010	6:00 PM	112	118	220	147	134
9/24/2010	7:00 PM	132	149	194	150	104
9/24/2010	8:00 PM	97	115	174	135	82
9/24/2010	9:00 PM	71	97	180	115	63
9/24/2010	10:00 PM	59	60	182	73	55
9/24/2010	11:00 PM	49	64	167	80	47
9/25/2010	12:00 AM	40	68	132	100	57
9/25/2010	1:00 AM	40	38	107	62	35
9/25/2010	2:00 AM	34	28	77	35	18
9/25/2010	3:00 AM	38	31	70	33	22
9/25/2010	4:00 AM	49	26	61	25	17
9/25/2010	5:00 AM	21	20	55	17	16
9/25/2010	6:00 AM	28	23	64	27	16
9/25/2010	7:00 AM	36	28	71	31	20
9/25/2010	8:00 AM	28	25	51	24	74
9/25/2010	9:00 AM	24	26	43	27	74
9/25/2010	10:00 AM	28	29	47	26	86
9/25/2010	11:00 AM	22	22	43	30	74
9/25/2010	12:00 PM	22	21	41	20	66
9/25/2010	1:00 PM	26	23	31	19	58
9/25/2010	2:00 PM	20	21	32	22	44
9/25/2010	3:00 PM	21	16	21	16	37

Date	Time	DHHS	Garden	Parkgate	Tudor	Palmer
		PM10	PM10	PM10	PM10	PM10
		ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
9/25/2010	4:00 PM	26	18	22	13	25
9/25/2010	5:00 PM	23	18	19	19	23
9/25/2010	6:00 PM	17	29	23	27	13
9/25/2010	7:00 PM	37	24	40	26	19
9/25/2010	8:00 PM	32	79	34	26	21
9/25/2010	9:00 PM	39	65	38	21	15
9/25/2010	10:00 PM	59	47	21	21	22
9/25/2010	11:00 PM	45	40	20	21	26
9/26/2010	12:00 AM	45	43	27	46	25
9/26/2010	1:00 AM	44	30	20	43	26
9/26/2010	2:00 AM	32	31	15	36	23
9/26/2010	3:00 AM	28	26	18	26	25
9/26/2010	4:00 AM	30	24	18	26	23
9/26/2010	5:00 AM	32	22	19	25	22
9/26/2010	6:00 AM	41	18	17	25	21
9/26/2010	7:00 AM	33	23	22	31	26
9/26/2010	8:00 AM	37	25	26	34	29
9/26/2010	9:00 AM	38	30	21	29	27
9/26/2010	10:00 AM	37	23	15	26	24
9/26/2010	11:00 AM	27	26	22	23	26
9/26/2010	12:00 PM	31	22	15	21	20
9/26/2010	1:00 PM	20	16	15	14	21
9/26/2010	2:00 PM	23	18	10	12	17
9/26/2010	3:00 PM	12	12	10	12	13
9/26/2010	4:00 PM	14	13	10	11	14
9/26/2010	5:00 PM	12	11	11	10	11
9/26/2010	6:00 PM	10	11	8	16	15
9/26/2010	7:00 PM	11	12	9	13	9
9/26/2010	8:00 PM	17	15	17	15	6
9/26/2010	9:00 PM	30	20	12	19	5
9/26/2010	10:00 PM	45	32	13	18	8
9/26/2010	11:00 PM	65	46	13	46	16
9/27/2010	12:00 AM	80	75	9	71	20
9/27/2010	1:00 AM	79	88	6	69	27
9/27/2010	2:00 AM	45	72	3	84	35
9/27/2010	3:00 AM	33	52	5	61	39
9/27/2010	4:00 AM	25	40	8	60	36
9/27/2010	5:00 AM	22	37	25	40	35
9/27/2010	6:00 AM	32	43	41	42	25
9/27/2010	7:00 AM	27	50	39	62	34
9/27/2010	8:00 AM	28	48	40	91	36
9/27/2010	9:00 AM	24	37	38	41	33
9/27/2010	10:00 AM	24	29	37	29	
9/27/2010	11:00 AM	28	21	38	23	28
9/27/2010	12:00 PM	25	22	34	20	16
9/27/2010	1:00 PM	37	22	38	28	17
9/27/2010	2:00 PM	31	24	30	25	11
9/27/2010	3:00 PM	23	25	27	23	10

Date	Time	DHHS	Garden	Parkgate	Tudor	Palmer
		PM10	PM10	PM10	PM10	PM10
		ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
9/27/2010	4:00 PM	17	15	20	16	16
9/27/2010	5:00 PM	17	17	16	18	10
9/27/2010	6:00 PM	17	17	21	29	11
9/27/2010	7:00 PM	26	29	15	27	13
9/27/2010	8:00 PM	36	35	10	36	13
9/27/2010	9:00 PM	37	33	11	22	12
9/27/2010	10:00 PM	25	39	9	19	13
9/27/2010	11:00 PM	32	32	14	17	15
9/28/2010	12:00 AM	36	29	10	30	12
9/28/2010	1:00 AM	14	15	10	17	12
9/28/2010	2:00 AM	13	16	11	18	15
9/28/2010	3:00 AM	19	14	12	16	10
9/28/2010	4:00 AM	20	18	12	24	11
9/28/2010	5:00 AM	23	12	22	37	17
9/28/2010	6:00 AM	24	25	38	18	30
9/28/2010	7:00 AM	43	40	49	36	40
9/28/2010	8:00 AM	28	46	72	42	43
9/28/2010	9:00 AM	31	33	28	54	41
9/28/2010	10:00 AM	18	23	31	32	50
9/28/2010	11:00 AM	25	24	35	29	24
9/28/2010	12:00 PM	31	24	34	35	19
9/28/2010	1:00 PM	33	24	21	28	16
9/28/2010	2:00 PM	22	17	27	16	14
9/28/2010	3:00 PM	20	21	25	19	12
9/28/2010	4:00 PM	23	13	31	23	16
9/28/2010	5:00 PM	21	15	34	19	21
9/28/2010	6:00 PM	16	16	22	14	20
9/28/2010	7:00 PM	10	21	36	14	22
9/28/2010	8:00 PM	10	30	31	35	9
9/28/2010	9:00 PM	10	53	26	42	12
9/28/2010	10:00 PM	12	41	14	57	12
9/28/2010	11:00 PM	11	43	14	57	12

Palmer Airport (PAAQ) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/22/2010	53	6	350	83	OVC060	10
9/22/2010	153	8	350	80	OVC060	10
9/22/2010	253	7	350	83	OVC060	10
9/22/2010	353	7	350	80	OVC060	10
9/22/2010	453	7	350	83	OVC060	10
9/22/2010	553	8	350	83	BKN060	10
9/22/2010	653	8	350	86	OVC055	10
9/22/2010	753	7	350	82	OVC055	10
9/22/2010	853	7	350	74	CLR	10
9/22/2010	953	6	340	68	BKN060	10
9/22/2010	1053	0	0	57	SCT065	8
9/22/2010	1153	3	VR	42	FEW070	10
9/22/2010	1253	5	VR	34	CLR	10
9/22/2010	1353	3	140	34	CLR	10
9/22/2010	1453	7	VR	37	FEW090	10
9/22/2010	1553	0	0	37	CLR	10
9/22/2010	1653	3	160	30	CLR	10
9/22/2010	1753	3	VR	51	OVC080	10
9/22/2010	1853	0	0	59	CLR	10
9/22/2010	1953	0	0	74	SCT085	10
9/22/2010	2053	0	0	77	BKN075	10
9/22/2010	2153	3	10	80	BKN075 OVC090	10
9/22/2010	2253	5	350	83	BKN075 BKN090	10
9/22/2010	2353	7	350	83	BKN075 OVC090	10
9/23/2010	53	9	340	83	FEW075	10
9/23/2010	153	9	350	82	CLR	10
9/23/2010	253	9	340	82	FEW100	10
9/23/2010	353	9	350	79	CLR	10
9/23/2010	453	8	340	70	BKN100	10
9/23/2010	553	3	20	89	SCT100	10
9/23/2010	653	5	30	89	BKN095	10
9/23/2010	753	7	360	58	FEW090	10
9/23/2010	853	0	0	71	FEW095	10
9/23/2010	953	3	VR	56	CLR	10
9/23/2010	1053	0	0	45	CLR	10
9/23/2010	1153	0	0	40	FEW100	10
9/23/2010	1253	3	150	37	FEW100	10
9/23/2010	1353	5	VR	36	BKN095	9
9/23/2010	1453	3	VR	36	CLR	10
9/23/2010	1553	0	0	33	SCT100	10
9/23/2010	1653	7	20	32	BKN100	10
9/23/2010	1753	18	30	32	CLR	10
9/23/2010	1853	18	30	32	FEW085	10
9/23/2010	1953	28	30	29	BKN120	9
9/23/2010	2053	32	30	28	OVC110	6
9/23/2010	2153	29	40	27	BKN100	8
9/23/2010	2253	39	40	24	BKN100	3
9/23/2010	2353	36	30	27	CLR	6
9/24/2010	53	33	30	28	CLR	6

Palmer Airport (PAAQ) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/24/2010	153	34	30	29	CLR	7
9/24/2010	253	36	30	31	FEW095	9
9/24/2010	353	33	30	31	SCT095	9
9/24/2010	453	34	30	28	SCT095	9
9/24/2010	553	34	40	27	BKN095	8
9/24/2010	653	28	50	27	FEW095	7
9/24/2010	753	37	40	27	CLR	7
9/24/2010	853	34	40	26	CLR	4
9/24/2010	953	38	30	24	CLR	5
9/24/2010	1053	34	40	23	CLR	6
9/24/2010	1153	37	40	23	CLR	4
9/24/2010	1253	43	40	21	CLR	2.5
9/24/2010	1310	39	40	21	CLR	4
9/24/2010	1335	36	50	20	CLR	2.5
9/24/2010	1351	33	50	21	CLR	4
9/24/2010	1353	34	40	20	CLR	4
9/24/2010	1404	31	40	20	CLR	2.5
9/24/2010	1414	37	50	20	CLR	3
9/24/2010	1420	34	40	20	CLR	1.75
9/24/2010	1453	34	50	19	CLR	1.5
9/24/2010	1505	20	60	20	CLR	3
9/24/2010	1521	30	50	20	CLR	2
9/24/2010	1528	37	50	20	CLR	1.75
9/24/2010	1553	29	50	19	M	1.5
9/24/2010	1602	38	50	20	M	2
9/24/2010	1609	33	50	20	M	1.75
9/24/2010	1617	M	M	20	M	M
9/24/2010	2053	39	40	28	BKN110	4
9/24/2010	2153	37	30	30	FEW120	7
9/24/2010	2253	38	40	28	CLR	5
9/24/2010	2353	36	40	27	FEW110	5
9/25/2010	53	31	40	28	SCT110	8
9/25/2010	153	29	40	28	FEW090	8
9/25/2010	253	31	30	28	BKN090	10
9/25/2010	353	24	30	31	BKN095	10
9/25/2010	453	22	30	31	SCT095	10
9/25/2010	553	13	50	31	CLR	10
9/25/2010	653	0	0	60	BKN090	10
9/25/2010	753	9	60	43	BKN090	10
9/25/2010	853	0	0	54	BKN190	10
9/25/2010	953	0	0	68	FEW090	10
9/25/2010	1053	3	160	54	SCT120 BKN200	10
9/25/2010	1150	7	140	M	SCT120 SCT200	10
9/25/2010	1254	M	M	37	M	10
9/25/2010	1353	7	160	M	M	10
9/25/2010	1453	0	0	32	FEW180	10
9/25/2010	1553	0	0	30	FEW160	10
9/25/2010	1653	0	0	30	FEW160	10
9/25/2010	1753	20	30	30	FEW180	10

Palmer Airport (PAAQ) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/25/2010	1853	14	40	31	SCT180	10
9/25/2010	1953	14	40	31	SCT180	10
9/25/2010	2053	5	150	42	FEW095	10
9/25/2010	2153	5	140	49	FEW100	10
9/25/2010	2253	0	0	65	CLR	10
9/25/2010	2353	0	0	65	BKN095	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/22/2010	16	3	200	71	OVC060	10
9/22/2010	36	0	0	71	OVC060	10
9/22/2010	56	0	0	71	OVC060	10
9/22/2010	116	0	0	71	OVC060	10
9/22/2010	136	0	0	71	OVC060	10
9/22/2010	156	0	0	77	OVC060	10
9/22/2010	216	0	0	77	OVC060	10
9/22/2010	236	0	0	77	OVC060	10
9/22/2010	256	0	0	77	OVC060	10
9/22/2010	316	0	0	77	OVC060	10
9/22/2010	336	0	0	77	OVC060	10
9/22/2010	356	0	0	77	OVC060	10
9/22/2010	416	0	0	80	OVC060	10
9/22/2010	436	0	0	80	OVC060	10
9/22/2010	456	0	0	80	OVC060	10
9/22/2010	516	0	0	74	OVC060	10
9/22/2010	536	0	0	74	OVC060	10
9/22/2010	556	0	0	74	OVC060	10
9/22/2010	616	0	0	74	OVC060	10
9/22/2010	636	0	0	74	OVC060	10
9/22/2010	656	0	0	74	OVC060	10
9/22/2010	716	0	0	79	OVC060	10
9/22/2010	736	0	0	79	OVC060	10
9/22/2010	756	0	0	79	BKN060	10
9/22/2010	816	0	0	74	BKN060	10
9/22/2010	836	0	0	74	OVC060	10
9/22/2010	856	5	40	71	OVC060	10
9/22/2010	916	3	60	71	OVC060	10
9/22/2010	936	0	0	71	BKN060	10
9/22/2010	956	0	0	68	SCT060	10
9/22/2010	1016	5	50	68	CLR	10
9/22/2010	1036	3	30	68	CLR	10
9/22/2010	1056	0	0	71	CLR	10
9/22/2010	1116	0	0	66	BKN060	10
9/22/2010	1136	3	30	66	BKN060	10
9/22/2010	1156	0	0	57	FEW060	10
9/22/2010	1216	3	10	57	CLR	10
9/22/2010	1236	0	0	57	CLR	10
9/22/2010	1256	3	20	53	CLR	10
9/22/2010	1316	3	10	51	CLR	10
9/22/2010	1336	3	350	45	CLR	10
9/22/2010	1356	3	330	42	CLR	10
9/22/2010	1416	0	0	45	CLR	10
9/22/2010	1436	3	290	45	CLR	10
9/22/2010	1456	5	270	45	CLR	10
9/22/2010	1516	3	270	49	CLR	10
9/22/2010	1536	3	250	49	CLR	10
9/22/2010	1556	5	270	49	CLR	10
9/22/2010	1616	3	260	49	CLR	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/22/2010	1636	5	280	49	CLR	10
9/22/2010	1656	3	260	49	CLR	10
9/22/2010	1716	3	270	49	CLR	10
9/22/2010	1736	3	230	49	CLR	10
9/22/2010	1756	0	0	49	CLR	10
9/22/2010	1816	0	0	49	CLR	10
9/22/2010	1836	0	0	53	CLR	10
9/22/2010	1856	5	130	55	CLR	10
9/22/2010	1916	6	120	63	CLR	10
9/22/2010	1936	7	130	59	CLR	10
9/22/2010	1956	7	130	59	CLR	10
9/22/2010	2016	8	130	59	CLR	10
9/22/2010	2036	7	130	59	CLR	10
9/22/2010	2056	7	120	59	CLR	10
9/22/2010	2116	7	130	54	CLR	10
9/22/2010	2136	8	130	54	CLR	10
9/22/2010	2156	7	130	54	CLR	10
9/22/2010	2216	8	130	50	CLR	10
9/22/2010	2236	7	130	50	FEW090	10
9/22/2010	2256	7	130	50	SCT090	10
9/22/2010	2316	5	100	50	BKN090	10
9/22/2010	2336	0	0	54	BKN080	10
9/22/2010	2356	0	0	65	SCT080	10
9/23/2010	16	3	80	60	BKN080	10
9/23/2010	36	3	60	60	FEW080	10
9/23/2010	56	0	0	60	CLR	10
9/23/2010	116	0	0	70	CLR	10
9/23/2010	136	0	0	70	CLR	10
9/23/2010	156	0	0	70	CLR	10
9/23/2010	216	0	0	76	CLR	10
9/23/2010	236	0	0	70	CLR	10
9/23/2010	256	0	0	70	CLR	10
9/23/2010	316	3	80	76	CLR	10
9/23/2010	336	3	50	65	CLR	10
9/23/2010	356	3	60	70	CLR	10
9/23/2010	416	0	0	70	CLR	10
9/23/2010	436	0	0	65	CLR	10
9/23/2010	456	0	0	70	CLR	10
9/23/2010	516	0	0	73	CLR	10
9/23/2010	536	0	0	70	CLR	10
9/23/2010	556	0	0	70	CLR	10
9/23/2010	616	0	0	70	CLR	10
9/23/2010	636	0	0	76	CLR	10
9/23/2010	656	0	0	76	CLR	10
9/23/2010	716	0	0	76	CLR	10
9/23/2010	736	0	0	76	CLR	10
9/23/2010	956	7	50	54	CLR	10
9/23/2010	1016	6	60	54	CLR	10
9/23/2010	1036	3	10	58	CLR	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/23/2010	1056	6	360	58	CLR	10
9/23/2010	1116	5	10	54	CLR	10
9/23/2010	1136	3	30	50	CLR	10
9/23/2010	1156	0	0	54	CLR	10
9/23/2010	1216	0	0	54	CLR	10
9/23/2010	1236	0	0	50	CLR	10
9/23/2010	1256	0	0	47	CLR	10
9/23/2010	1316	3	350	37	CLR	10
9/23/2010	1336	0	0	40	CLR	10
9/23/2010	1356	3	20	39	CLR	10
9/23/2010	1416	5	60	39	CLR	10
9/23/2010	1436	3	60	39	CLR	10
9/23/2010	1456	3	20	39	CLR	10
9/23/2010	1516	3	350	42	CLR	10
9/23/2010	1536	3	30	42	CLR	10
9/23/2010	1556	3	40	39	CLR	10
9/23/2010	1616	0	0	39	CLR	10
9/23/2010	1636	0	0	42	CLR	10
9/23/2010	1656	0	0	39	CLR	10
9/23/2010	1716	0	0	42	SCT095	10
9/23/2010	1736	3	300	46	FEW095	10
9/23/2010	1756	7	40	49	CLR	10
9/23/2010	1816	7	40	39	CLR	10
9/23/2010	1836	10	40	35	CLR	10
9/23/2010	1856	7	40	38	CLR	10
9/23/2010	1916	7	40	40	CLR	10
9/23/2010	1936	6	80	44	CLR	10
9/23/2010	1956	8	50	41	BKN120	10
9/23/2010	2016	14	50	38	OVC120	10
9/23/2010	2036	14	50	32	OVC120	10
9/23/2010	2056	17	50	30	OVC120	7
9/23/2010	2116	21	50	32	FEW090 OVC120	5
9/23/2010	2136	20	50	29	BKN090 OVC120	6
9/23/2010	2156	21	50	32	BKN090 OVC120	8
9/23/2010	2216	18	50	32	OVC120	8
9/23/2010	2236	21	50	30	BKN110	10
9/23/2010	2256	21	50	30	FEW120	10
9/23/2010	2316	23	50	30	SCT090	9
9/23/2010	2336	21	50	30	BKN090	8
9/23/2010	2356	23	60	30	SCT090	10
9/24/2010	16	22	50	30	BKN090	10
9/24/2010	36	26	50	30	SCT090	10
9/24/2010	56	23	50	31	BKN090	10
9/24/2010	116	24	50	31	SCT090	10
9/24/2010	136	21	50	29	BKN090	10
9/24/2010	156	24	50	29	SCT090	10
9/24/2010	256	25	50	29	CLR	10
9/24/2010	316	23	50	31	CLR	10
9/24/2010	336	23	50	28	CLR	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/24/2010	356	22	50	28	CLR	10
9/24/2010	416	24	50	28	CLR	10
9/24/2010	616	20	50	28	CLR	10
9/24/2010	636	21	40	28	CLR	10
9/24/2010	656	20	50	28	CLR	10
9/24/2010	716	23	50	28	CLR	10
9/24/2010	736	21	50	28	CLR	10
9/24/2010	1656	25	50	23	M	10
9/24/2010	1716	24	50	25	CLR	10
9/24/2010	1736	17	50	25	CLR	10
9/24/2010	1756	17	50	28	CLR	10
9/24/2010	1816	21	60	27	CLR	10
9/24/2010	1836	16	50	25	CLR	10
9/24/2010	1856	22	60	25	CLR	10
9/24/2010	1916	21	60	25	SCT120	10
9/24/2010	1936	18	50	25	BKN110	10
9/24/2010	1956	21	50	25	OVC120	10
9/24/2010	2016	25	60	27	OVC110	10
9/24/2010	2036	20	60	27	SCT070 BKN090 OVC100	10
9/24/2010	2056	22	50	27	BKN060 OVC080	10
9/24/2010	2116	25	50	31	FEW060 OVC090	10
9/24/2010	2136	20	50	31	OVC090	10
9/24/2010	2156	20	50	31	SCT100 BKN120	10
9/24/2010	2216	20	50	31	BKN120	10
9/24/2010	2236	21	50	31	BKN120	10
9/24/2010	2256	17	50	31	OVC110	10
9/24/2010	2316	22	50	31	BKN110	10
9/24/2010	2336	20	50	31	SCT110	10
9/24/2010	2356	18	50	31	SCT110	10
9/25/2010	16	16	40	31	CLR	10
9/25/2010	36	18	50	31	SCT120	10
9/25/2010	56	20	50	31	OVC110	10
9/25/2010	116	16	50	31	OVC100	10
9/25/2010	136	16	50	31	SCT075 OVC090	10
9/25/2010	156	10	50	31	OVC080	10
9/25/2010	216	14	40	31	OVC080	10
9/25/2010	236	15	50	34	OVC080	10
9/25/2010	256	16	50	31	OVC090	10
9/25/2010	316	14	50	34	FEW075 SCT090 BKN110	10
9/25/2010	336	13	50	37	FEW110	10
9/25/2010	356	10	50	37	SCT080	10
9/25/2010	416	11	50	34	FEW080	10
9/25/2010	436	10	50	34	CLR	10
9/25/2010	456	8	50	37	CLR	10
9/25/2010	516	6	50	40	FEW110	10
9/25/2010	536	3	180	46	BKN110	10
9/25/2010	556	0	0	48	OVC110	10
9/25/2010	616	0	0	45	OVC100	10
9/25/2010	636	0	0	52	OVC100	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/25/2010	656	0	0	48	OVC100	10
9/25/2010	716	3	200	52	OVC110	10
9/25/2010	736	3	200	48	OVC110	10
9/25/2010	756	3	160	48	OVC110	10
9/25/2010	816	3	190	53	BKN120	10
9/25/2010	836	6	200	49	OVC120	10
9/25/2010	856	5	240	45	OVC120	10
9/25/2010	916	6	180	45	SCT120	10
9/25/2010	936	0	0	45	CLR	10
9/25/2010	956	3	200	45	CLR	10
9/25/2010	1016	5	210	42	SCT120	10
9/25/2010	1036	5	210	42	BKN120	10
9/25/2010	1056	6	210	46	FEW120	10
9/25/2010	1116	5	220	42	CLR	10
9/25/2010	1136	3	80	40	CLR	10
9/25/2010	1156	6	240	40	CLR	10
9/25/2010	1216	0	0	34	CLR	10
9/25/2010	1236	0	0	34	CLR	10
9/25/2010	1256	3	280	32	CLR	10
9/25/2010	1316	0	0	30	CLR	10
9/25/2010	1336	7	350	30	CLR	10
9/25/2010	1356	8	10	35	CLR	10
9/25/2010	1416	9	290	35	CLR	10
9/25/2010	1436	5	300	35	CLR	10
9/25/2010	1456	7	300	32	CLR	10
9/25/2010	1516	6	300	30	CLR	10
9/25/2010	1536	7	300	32	CLR	10
9/25/2010	1556	6	300	32	CLR	10
9/25/2010	1616	6	300	33	CLR	10
9/25/2010	1636	3	280	33	CLR	10
9/25/2010	1656	3	250	38	CLR	10
9/25/2010	1716	3	280	35	CLR	10
9/25/2010	1736	0	0	38	CLR	10
9/25/2010	1756	0	0	38	CLR	10
9/25/2010	1816	3	130	35	CLR	10
9/25/2010	1836	5	140	32	CLR	10
9/25/2010	1856	7	130	34	CLR	10
9/25/2010	1916	5	150	44	CLR	10
9/25/2010	1936	5	110	46	CLR	10
9/25/2010	1956	5	110	40	CLR	10
9/25/2010	2016	5	90	37	CLR	10
9/25/2010	2036	0	0	39	CLR	10
9/25/2010	2056	3	180	45	CLR	10
9/25/2010	2116	5	170	45	CLR	10
9/25/2010	2136	6	140	42	CLR	10
9/25/2010	2156	9	200	53	CLR	10
9/25/2010	2216	7	200	49	CLR	10
9/25/2010	2236	8	200	49	CLR	10
9/25/2010	2256	8	220	53	CLR	10

Birchwood Airport (PAVB) Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Date	Time (LST)	Wind Speed (mph)	Wind Direction	Relative Humidity (%)	Sky Condition	Visibility (SM)
9/25/2010	2316	8	220	49	CLR	10
9/25/2010	2336	6	220	45	CLR	10
9/25/2010	2356	10	230	42	CLR	10

Anchorage International Airport (PANC)
Source: NCDC Quality Controlled Local Climatological Data (DS3505)

AK STD TIME	Wind Speed (mph)	Wind Direction	Sky Condition	Visibility (SM)
9/22/10 0:00	5	180	OVC	10
9/22/10 1:00	3	180	OVC	10
9/22/10 2:00	3	990	OVC	10
9/22/10 3:00	0	***	OVC	10
9/22/10 3:00	0	***	OVC	10
9/22/10 4:00	0	***	BKN	10
9/22/10 5:00	0	***	BKN	10
9/22/10 6:00	0	***	BKN	10
9/22/10 7:00	3	340	BKN	10
9/22/10 8:00	0	***	BKN	10
9/22/10 9:00	5	20	OVC	10
9/22/10 9:00	5	20	OVC	10
9/22/10 10:00	7	40	CLR	10
9/22/10 11:00	6	60	SCT	10
9/22/10 12:00	3	990	SCT	10
9/22/10 13:00	6	60	CLR	10
9/22/10 14:00	5	330	SCT	10
9/22/10 15:00	7	330	SCT	10
9/22/10 15:00	7	330	SCT	10
9/22/10 16:00	6	330	SCT	10
9/22/10 17:00	0	***	SCT	10
9/22/10 18:00	0	***	SCT	10
9/22/10 19:00	0	***	SCT	10
9/22/10 20:00	3	990	SCT	10
9/22/10 21:00	3	150	CLR	10
9/22/10 21:00	3	150	CLR	10
9/22/10 22:00	6	150	SCT	10
9/22/10 23:00	0	***	SCT	10
9/23/10 0:00	0	***	SCT	10
9/23/10 1:00	6	160	SCT	10
9/23/10 2:00	3	160	CLR	10
9/23/10 3:00	0	***	CLR	10
9/23/10 3:00	0	***	CLR	10
9/23/10 4:00	3	140	CLR	10
9/23/10 5:00	0	***	SCT	10
9/23/10 6:00	0	***	SCT	10
9/23/10 7:00	0	***	SCT	10
9/23/10 8:00	0	***	SCT	10
9/23/10 9:00	5	340	SCT	10
9/23/10 9:00	5	340	SCT	10
9/23/10 10:00	6	360	SCT	10
9/23/10 11:00	6	10	SCT	10
9/23/10 12:00	7	40	SCT	10
9/23/10 13:00	8	50	SCT	10
9/23/10 14:00	9	50	SCT	10
9/23/10 15:00	6	40	SCT	10
9/23/10 15:00	6	40	SCT	10
9/23/10 16:00	8	40	SCT	10

Anchorage International Airport (PANC)
Source: NCDC Quality Controlled Local Climatological Data (DS3505)

AK STD TIME	Wind Speed (mph)	Wind Direction	Sky Condition	Visibility (SM)
9/23/10 17:00	5	50	SCT	10
9/23/10 18:00	0	***	SCT	10
9/23/10 19:00	0	***	SCT	10
9/23/10 20:00	15	40	SCT	10
9/23/10 21:00	11	40	SCT	10
9/23/10 21:00	11	40	SCT	10
9/23/10 22:00	8	40	SCT	10
9/23/10 23:00	0	***	SCT	10
9/24/10 0:00	14	40	BKN	10
9/24/10 1:00	15	30	SCT	10
9/24/10 2:00	16	30	SCT	10
9/24/10 3:00	17	20	SCT	10
9/24/10 3:00	17	20	SCT	10
9/24/10 4:00	22	20	SCT	10
9/24/10 5:00	22	20	SCT	10
9/24/10 6:00	15	330	SCT	10
9/24/10 7:00	18	350	SCT	10
9/24/10 8:00	19	360	CLR	10
9/24/10 9:00	26	30	SCT	10
9/24/10 9:00	26	30	SCT	10
9/24/10 10:00	29	20	CLR	10
9/24/10 11:00	23	20	CLR	10
9/24/10 12:00	26	20	CLR	10
9/24/10 13:00	32	20	CLR	10
9/24/10 14:00	24	20	CLR	10
9/24/10 15:00	36	30	CLR	10
9/24/10 15:00	36	30	CLR	10
9/24/10 16:00	34	30	CLR	6
9/24/10 17:00	33	30	CLR	6
9/24/10 18:00	21	20	CLR	10
9/24/10 19:00	23	30	CLR	6
9/24/10 20:00	21	40	SCT	6
9/24/10 21:00	23	40	BKN	10
9/24/10 21:00	23	40	BKN	10
9/24/10 22:00	24	30	BKN	10
9/24/10 23:00	19	30	BKN	10
9/25/10 0:00	21	20	BKN	10
9/25/10 1:00	17	30	BKN	10
9/25/10 2:00	18	10	OVC	10
9/25/10 3:00	15	10	BKN	10
9/25/10 3:00	15	10	BKN	10
9/25/10 4:00	15	360	OVC	10
9/25/10 5:00	18	360	OVC	10
9/25/10 6:00	15	360	BKN	10
9/25/10 7:00	13	350	BKN	10
9/25/10 8:00	17	350	BKN	10
9/25/10 9:00	17	350	BKN	10
9/25/10 9:00	17	350	BKN	10

Anchorage International Airport (PANC)
Source: NCDC Quality Controlled Local Climatological Data (DS3505)

AK STD TIME	Wind Speed (mph)	Wind Direction	Sky Condition	Visibility (SM)
9/25/10 10:00	15	350	SCT	10
9/25/10 11:00	14	350	BKN	10
9/25/10 12:00	14	330	BKN	10
9/25/10 13:00	11	340	SCT	10
9/25/10 14:00	14	330	SCT	10
9/25/10 15:00	11	340	SCT	10
9/25/10 15:00	11	340	SCT	10
9/25/10 16:00	8	340	SCT	10
9/25/10 17:00	8	350	SCT	10
9/25/10 18:00	3	990	SCT	10
9/25/10 19:00	0	***	SCT	10
9/25/10 20:00	0	***	SCT	10
9/25/10 21:00	8	350	CLR	10
9/25/10 21:00	8	350	CLR	10
9/25/10 22:00	10	350	CLR	10
9/25/10 23:00	14	360	CLR	10