

PM<sub>10</sub> Exceptional Events Waiver Request  
Parkgate station in Eagle River, AK (AQS Site ID = 02-020-1004)  
October 30 & 31, 2009

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

November 4, 2010

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## A. Event criteria

### Event affected air quality

In late October 2009, a weather system surrounding Alaska created a large pressure gradient over south-central Alaska, and this resulted in extremely strong N-NE winds that blew across the region during 29-31 October. This weather pattern is fairly common in the winter in this region and a resulting strong northerly wind is locally known as Matanuska Wind. The Matanuska Wind of 29-31 October 2009 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 at low elevations, generated massive wind-blown dust clouds from glacial outwash of major glacial rivers across the entire region (Figure 1).

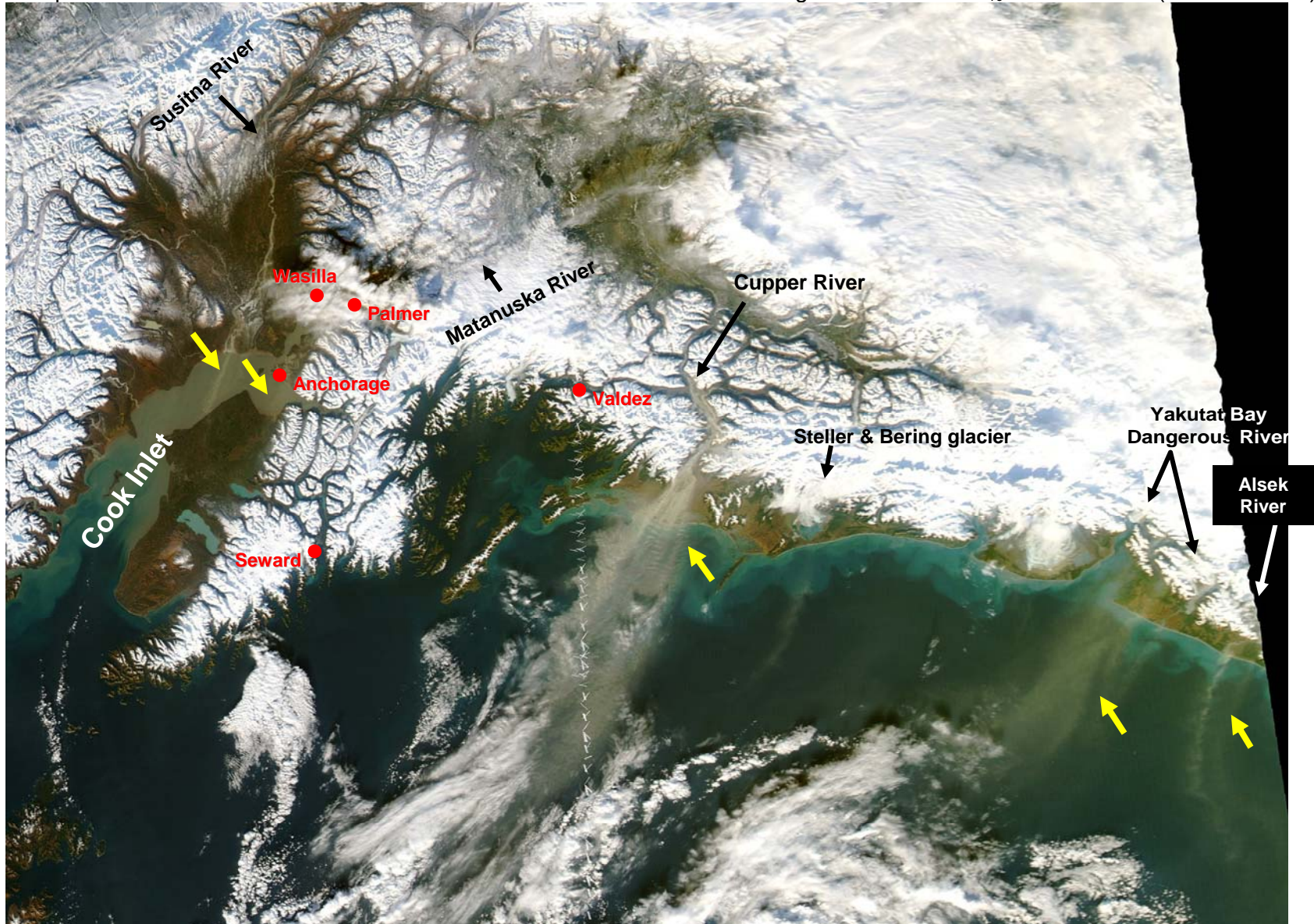
On 29 October an Air Quality Warning was issued by the Mat-Su Borough for the Palmer area, because the concentration of wind-blown dust (PM<sub>10</sub>) in the air reached unhealthy levels (Appendix A). The Municipality of Anchorage also issued an Air Quality Advisory on 30 October because the PM<sub>10</sub> concentration was approaching unhealthy levels due to airborne dust transported from Palmer (Appendix B).

The unusually dusty conditions were reflected in PM<sub>10</sub> concentrations monitored adjacent to the Matanuska River delta in Palmer and at monitoring sites directly downwind of the delta in Eagle River and Anchorage (Table 1). The 24-hr averages of PM<sub>10</sub> at monitoring stations in all these three sites recorded ambient concentrations that were significantly higher than normal. The 24-hr PM<sub>10</sub> concentration at the Parkgate monitoring station in Eagle River was 163 µg/m<sup>3</sup> on 30 October and remained high (137 µg/m<sup>3</sup>) on the following day. The Wasilla site, located approximately 11 miles west of the mouth of Matanuska River and 30 miles east of Susitna River did not record extremely high PM<sub>10</sub>, because the site was not directly downwind of either river during this particular wind storm (Table 1, Figure 1).

**Table 1. The 24-hr average PM<sub>10</sub> 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 Alaska Dept. of Environmental Conservation. Asterisks indicate the events requested for consideration as exceptional events. All data are in the AQS database except for those from the Wasilla station where the sampler's flow rate slightly exceeded ADEC's QA criteria. However the flow rate deviation was within the EPA's QA criteria, and thus the data were included in the table below.

Monitoring station ID		Directly downwind from Matanuska Valley?	24-hr average PM <sub>10</sub> (µg/m <sup>3</sup> )		
Site	Station		29 Oct	30 Oct	31 Oct
Wasilla	Wasilla	No	40	53	52
Palmer	Palmer	Yes	139	137	204
<b>Eagle River</b>	<b>Parkgate</b>	<b>Yes</b>	<b>41</b>	<b>163*</b>	<b>137*</b>
Anchorage	Garden	Yes	41	123	123

**Figure 1 . AVHRR Satellite image of windblown dust in entire south-central Alaska at 15:11 AST on 30 October, 2009.** Yellow arrows show dust plumes trailing from NE to SW. The dust plume from the Copper River Valley is especially prominent; plumes from the Matanuska River delta near Palmer can also be seen. Note that valley bottoms and plains are snow free and that dust plumes from the Matanuska River and the Susitna River are narrow enough not to affect PM<sub>10</sub> at Wasilla site (source: NASA).



Event was not reasonably controllable or preventable

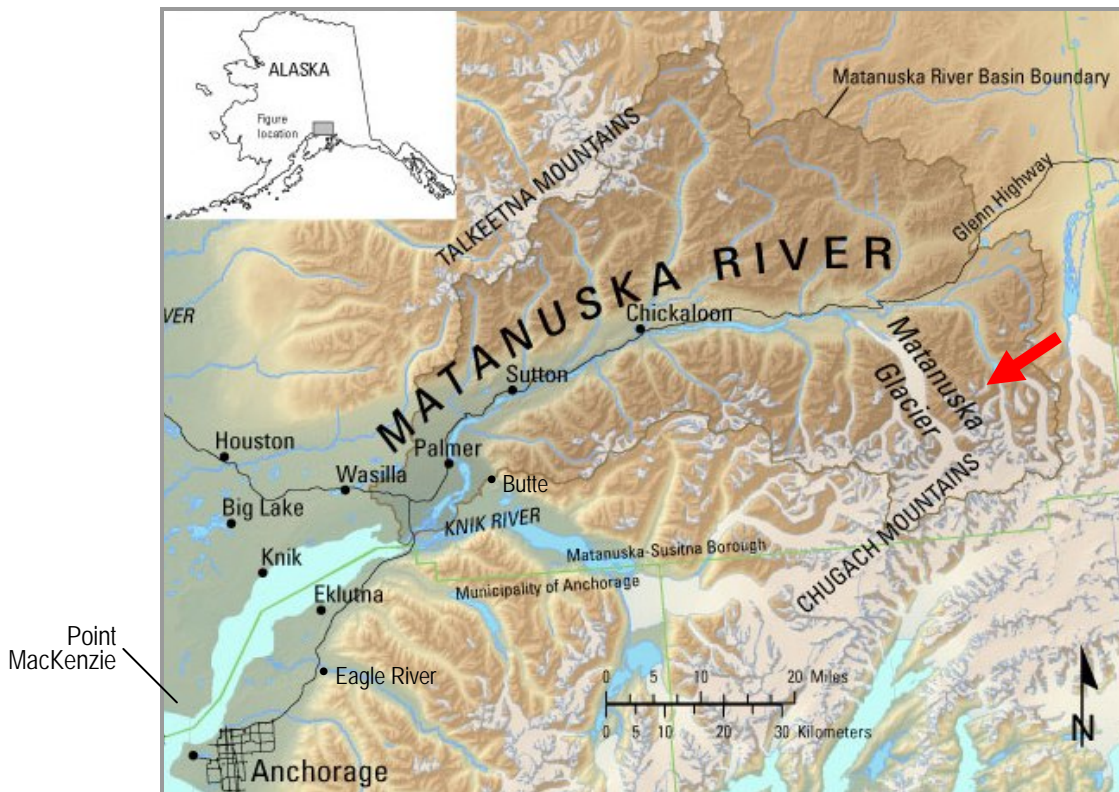
As we will describe below in detail, the key factors leading to the exceedance at the Parkgate monitoring station in Eagle River were: (1) **a large naturally-occurring reservoir of loose glacial silt deposits** on the glacial outwash plain along Matanuska River; (2) **unusually strong N-NE winds (Matanuska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

We define “unusually strong wind” as wind with maximum wind gust of 40 mph or greater. Weather records from at the Anchorage International Airport (PANC) from the 17 year period (1993–2009) indicate that winds greater than 40 mph are rare. Only 2% of the days during this period recorded maximum wind gusts of  $\geq 40$  mph. Because no wind data are available for Eagle River, 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, ~6 miles NE of Eagle River<sup>1</sup>.

▪ *Natural PM<sub>10</sub> 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. 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](http://ak.water.usgs.gov/MatSu/mrbe/data_pubs.php) was modified)

<sup>1</sup> Weather data were obtained from NCDC Quality Controlled Local Climatological Data (DS3505)

Because glacial braided rivers constantly change their course, they prevent the establishment of vegetation on the outwash plain that could effectively suppress wind erosion. Along the upper stretch of the river the outwash plain can be protected from winds by the narrow and deep Matanuska Valley, whereas the lower stretch of the river (a segment between Sutton, where valley widens, and the river delta near Palmer) the outwash plain 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<sup>2</sup> or 3212 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](http://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<sub>10</sub> level during the event. A considerable portion of agricultural land near 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. Total agricultural land that was most likely tilled or turned in 2007 was estimated to be only 2 km<sup>2</sup> or 494 acres (15% of the unvegetated area on braided outwash plain) for a Matanuska Valley – Palmer area<sup>2</sup>. We conservatively assumed that agricultural land use and

<sup>2</sup> 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<sup>2</sup> 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<sup>2</sup>. 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.

practice in 2009 was similar to that in 2007, although total crop land declined by 12% and harvested land by 3% over a 2002 – 2007 period<sup>3</sup>.

Because of Alaska's short growing season, annual field crops are normally harvested by late August and the land is normally turned by mid-late September for the next spring. Thus, tilled areas would have been undisturbed for over a month prior to the wind storm of October 2009, making this land more resistant to wind erosion. Furthermore, the soil turning in September creates rough ground surface suppressing wind-blown dust emissions relative to a smooth surface like the braided outwash plain<sup>4</sup>.

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<sup>2</sup>) and it was 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 not likely 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<sup>5</sup>.

#### 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 4)<sup>6</sup>.

Recent studies have revealed that long-range transport of PM<sub>10</sub> 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<sup>7</sup>. 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 (<45 miles) on an occasional basis when strong wind storms coincide with other environmental factors conducive to dust generation.

We concluded based on the four points listed below that the exceedance on 30 October 2009 at the Parkgate monitoring station was caused by the unusually strong Matanuska Wind and not by anthropogenic activities (e.g., industrial, traffic).

1. The nearest sizeable industrial center is Anchorage, about 18 miles SW of Parkgate monitoring station in Eagle River. If industrial sources had much influence on PM<sub>10</sub> levels in Eagle River,

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<sup>3</sup> Census results (2007) reported by NASS. Available at: <http://www.agcensus.usda.gov/>

<sup>4</sup> For example, see the EPA document AP-42, Compilation of Air Pollutant Emission Factors, section 13.2.5.

<sup>5</sup> 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<sup>2</sup>, assuming that the average trail width is 4 ft. This is only 1% of braided outwash plain (13km<sup>2</sup>). 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.

<sup>6</sup> Soil Survey of Matanuska-Susitna Valley Area, Alaska. United States Department of Agriculture, Natural Resources Conservation Service (Aug 1998).

<sup>7</sup> 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.

strong S-SW wind should be associated with higher PM<sub>10</sub> concentrations. However, a comparison of wind directions and PM<sub>10</sub> concentrations during the 1998-2009 period revealed no association between the two. The highest PM<sub>10</sub> value measured at Parkgate during unusually strong S-SW wind events ( $\geq 40$  mph, measured at PANC) was only 19  $\mu\text{g}/\text{m}^3$  (Table 2, middle column).

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<sub>10</sub> in both Eagle River and Anchorage. The very low carbon content indicates that PM<sub>10</sub> derived from combustion sources such as wood burning and industrial activity are not important sources of PM<sub>10</sub> in Eagle River and Anchorage.
3. Table 1 does not show any indication of PM<sub>10</sub> transport from Anchorage to Eagle River; the progression of PM<sub>10</sub> front from Palmer to Eagle River during the wind storm of 29-31 October 2009 is very evident.
4. Finally, no unusual human activities were recorded in Eagle River or Anchorage during the exceedance event that could have emitted a large amount of PM<sub>10</sub>.

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

**Figure 4. 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)

**Table 2. Comparison of gust speed (daily maximum) and wind direction at PANC and PM<sub>10</sub> concentration (24-hr average) in Eagle River during 1998-2009 period.** Gust speed and snow depth data at PANC station (Anchorage International Airport) were obtained from Quality Controlled Local Climatological Data by National Climatic Data Center (NCDC). Only days with gusts ≥35 mph are shown. PM<sub>10</sub> measurements were available from 1012 days during this period.

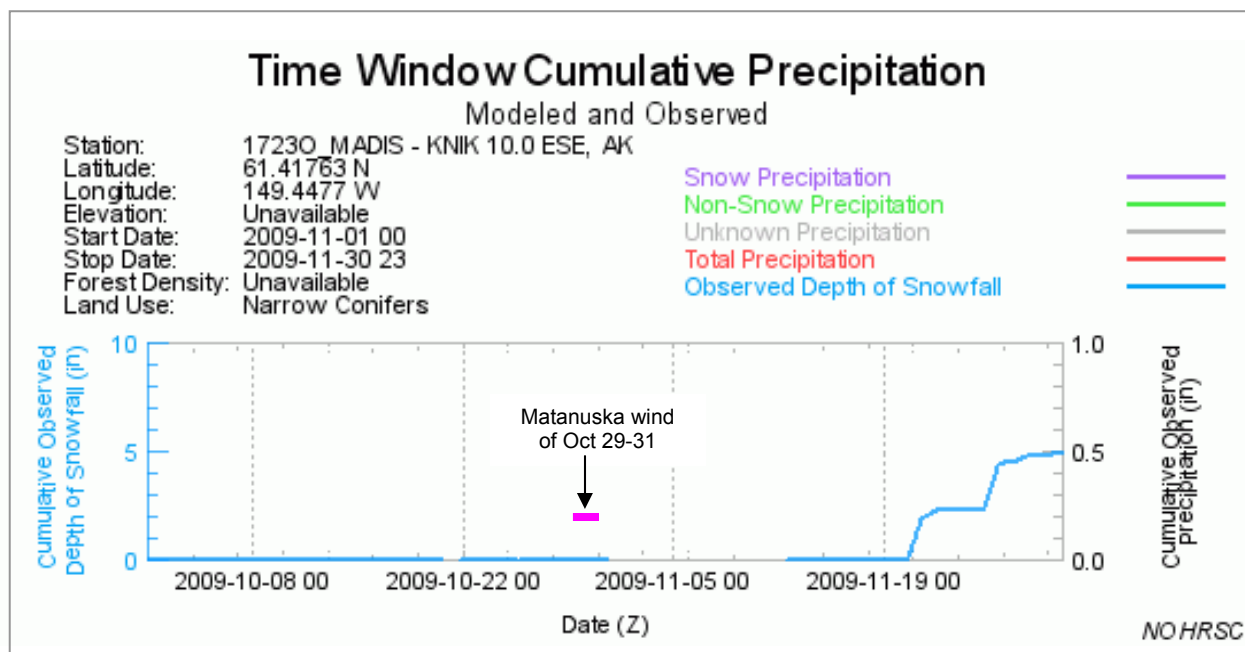
N-NE gust (from Palmer)					S-SW gust (from Anchorage)					Gust from other directions				
Date	snow depth (")	gust (mph)	direction	Parkgate PM10 (ug/m3)	Date	snow depth (")	gust (mph)	direction	Parkgate PM10 (ug/m3)	Date	snow depth (")	gust (mph)	direction	Parkgate PM10 (ug/m3)
3/12/2003	0	71	N	590	1/16/2009	5	54	S	3	9/21/2000	0	47	SE	19
3/1/2007	17	54	N	28	4/22/2005	0	51	S	10	1/30/2007	18	47	SE	9
12/2/2007	0.01	48	NE	223	1/15/2009	10	47	S	4	11/11/2009	2	47	SE	24
10/31/2009	0	45	NE	137	6/5/2007	0	46	S	19	12/20/2000	4	45	SE	8
10/29/2009	0	43	N	41	3/31/1999	9	41	S	6	12/26/1999	5	43	SE	7
3/13/2007	17	40	N	29	12/2/2009	8	41	S	3	1/14/2002	10	43	SE	3
2/20/2009	9	40	N	7	7/27/2009	0	40	S	12	4/27/2004	0	43	SE	18
10/30/2009	0	40	N	163	1/4/2005	4	39	S	3	7/31/2009	0	41	SE	10
11/13/2006	4	39	N	65	7/11/2007	0	39	S	19	12/1/2009	7	41	SE	2
11/19/2006	4	39	N	30	11/8/2007	0	39	S	11	7/5/1999	0	40	SE	66
2/21/2009	9	39	N	9	8/4/1999	0	38	S	17	1/7/2001	0.001	39	E	2
12/8/2008	8	37	N	16	9/4/2001	0	37	S	6	2/18/2008	15	39	SE	4
1/30/1999	7	36	N	20	12/4/2002	0	37	S	12	5/27/2003	0	38	SE	10
12/19/2006	9	36	N	9	10/19/2005	0	37	S	5	3/11/2005	7	38	SE	3
9/27/2000	0	35	N	8	2/10/2006	11	37	S	3	12/8/2007	0.01	38	SE	46
1/13/2001	4	35	N	6	2/14/2009	10	37	S	4	4/24/2008	0	38	SE	53
12/29/2004	7	35	N	7	6/25/2009	0	37	S	12	1/17/2009	5	38	SE	7
11/4/2009	0	35	N	64	9/7/2009	0	37	S	15	9/1/2009	0	38	SE	15
					11/23/2009	3	37	S	9	11/1/1998	0	37	SE	27
					3/18/1998	8	36	S	12	1/19/2001	1	37	SE	11
					12/20/1999	7	36	SW	26	12/23/2004	5	37	SE	10
					4/18/2000	0.001	36	S	43	1/18/2009	5	37	SE	5
					5/1/2001	0	36	S	19	4/26/2009	0	37	SE	21
					7/2/2003	0	36	S	11	5/21/2009	0	37	SE	23
					2/21/2004	23	36	S	4	9/30/2003	0	36	SE	6
					5/27/2004	0	36	S	14	11/29/2004	2	36	SE	10
					5/5/2006	0	36	S	16	6/10/2006	0	36	SE	15
					5/30/2007	0	36	S	15	5/28/2009	0	36	SE	11
					3/7/2008	9	36	S	5	7/29/2009	0	36	SE	15
					2/19/2009	9	36	S	7	11/14/2000	0	35	SE	13
					5/22/2009	0	36	S	21	9/5/2002	0	35	SE	17
					5/26/2009	0	36	S	47	8/13/2003	0	35	SE	3
					8/18/2009	0	36	S	16	4/9/2004	20	35	SE	24
					7/5/2000	0	35	SW	8	3/31/2008	5	35	SE	21
					12/27/2001	7	35	S	4	5/30/2008	0	35	SE	40
					5/9/2003	0	35	S	18	5/27/2009	0	35	SE	17
					5/15/2004	0	35	S	17	6/21/2009	0	35	SE	9
					7/10/2006	0	35	S	14	7/26/2009	0	35	SE	12
					1/12/2007	21	35	S	6	10/2/2009	0	35	SE	20
					7/17/2007	0	35	S	24	11/24/2009	3	35	SE	11
					5/12/2008	0	35	S	18					
					3/5/2009	14	35	S	6					

\* the same wind storm of 29-31 Oct 2009  
 yellow highlight = N-NE gust of ≥40 mph and snow depth ≤0.01"  
 Black letters = PM10 measured using FRM (1-in-6 day)  
 Blue letters = PM10 measured using BAM (daily)  
 E = Exceptional event status granted or requested

## B. Clear causal relationship

In the winter of 2009-2010, the snow cover in Palmer area needed to prevent wind-blown dust was not present until November 19 (Figure 5). This snow-free condition allowed the Matanuska Wind of October 29-31 to stir-up loose silt deposits in the glacial outwash and generate a large dust cloud, which was subsequently transported to downwind locations.

**Figure 5. Snow depth recorded in Palmer, AK between October 1 and November 30, 2009.**



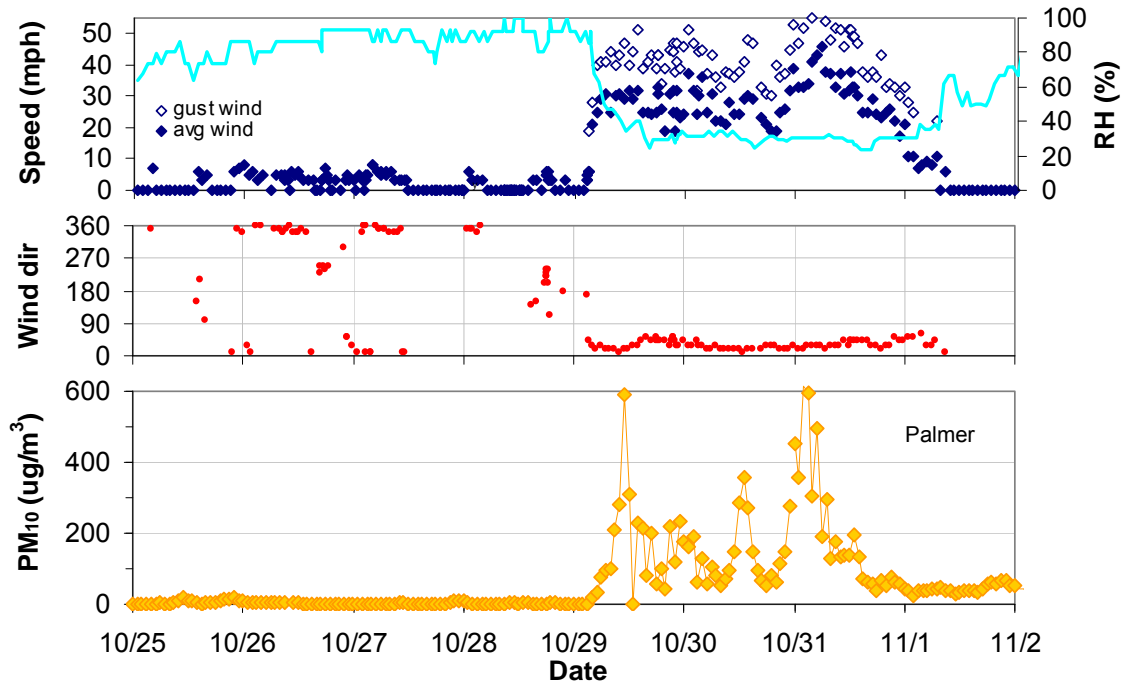
(Source: NOAA National Operational Hydrologic Remote Sensing Center [www.nohrsc.noaa.gov](http://www.nohrsc.noaa.gov) )

We analyzed the relationship between hourly  $PM_{10}$  concentration and wind speed, wind direction, and relative humidity between 25 October and 2 November 2009 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 29-31 October 2009. The climate at Palmer Airport (PAAQ), Birchwood Airport (PABV), and PANC data were used for the analysis, and the data were obtained from Quality Controlled Local Climatological Data by NCDC (Appendix C).  $PM_{10}$  data used in the analysis were from the Palmer, Parkgate, and Garden sampling stations.

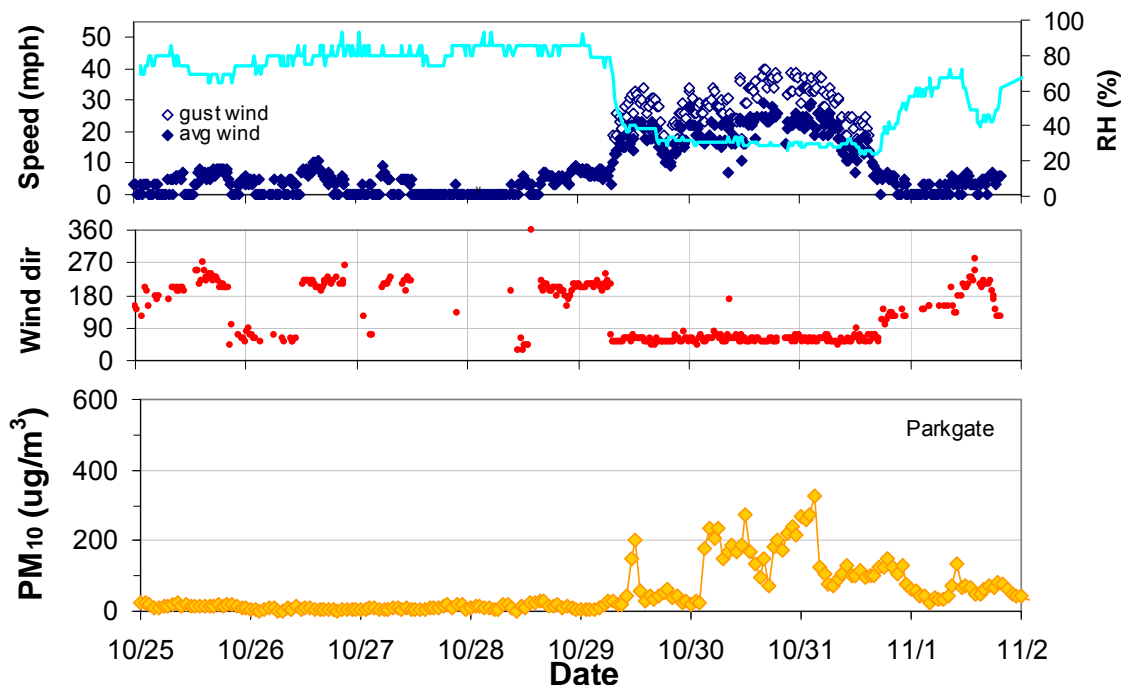
The results shown in Figure 6 clearly show the progression of the wind and  $PM_{10}$  front from the Palmer area to Anchorage, indicating that the exceedance at Parkgate station was caused by the transport of wind-blown dust that originated near Palmer. At the Palmer station the  $PM_{10}$  concentration reached  $309 \mu\text{g}/\text{m}^3$  on October 29 soon after the dry Matanuska wind (RH <40%) from the north started to blow, and hourly  $PM_{10}$  concentrations remained high with some fluctuations that correspond to gust speed variations until the end of the storm on October 31 (Figure 6-A). During this storm, the hourly  $PM_{10}$  concentration at Wasilla station remained below  $150 \mu\text{g}/\text{m}^3$  with only two exceptions ( $181$  and  $198 \mu\text{g}/\text{m}^3$ , data not shown), resulting in low 24-hr average throughout the storm (Table 1). The low  $PM_{10}$  values at Wasilla station regardless of considerably strong gusts (maximum = 41 mph), indicates the importance of a direct down-wind location from Matanuska Valley for elevated  $PM_{10}$  during the storm.

**Figure 6. Progression of wind and PM<sub>10</sub> front from Palmer to Anchorage during the wind storm in October 2009.** Speed = average wind and gust speed; Wind dir = wind direction in degrees; RH = Relative humidity.

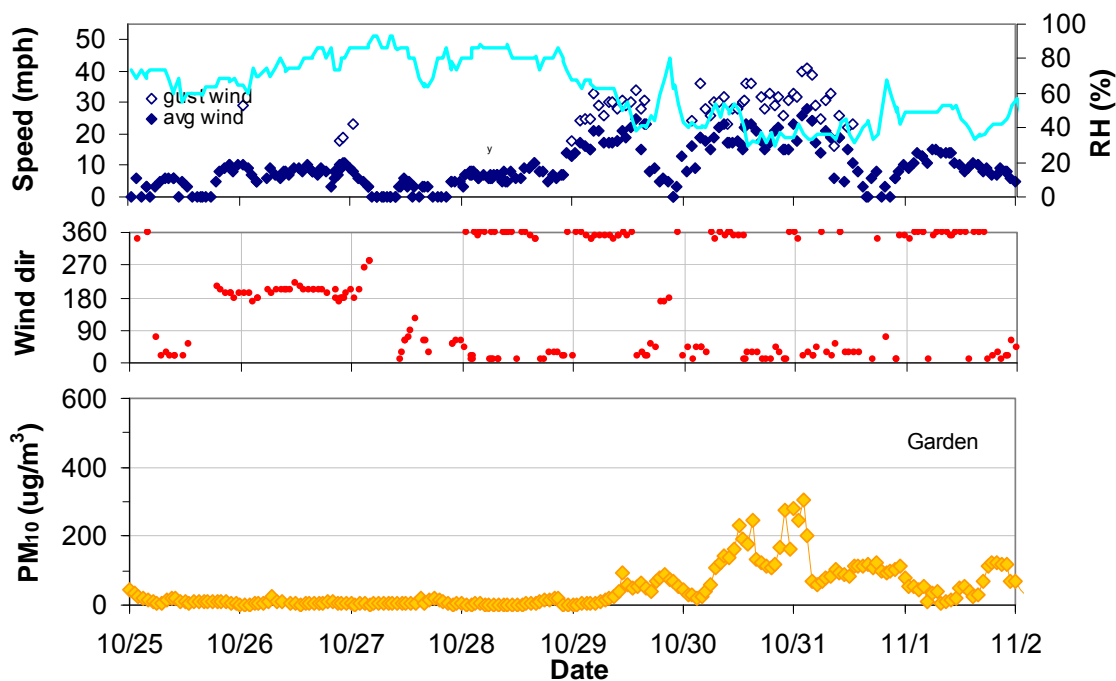
**(A) Palmer** (weather data = PAAQ; PM<sub>10</sub> data = Palmer station)



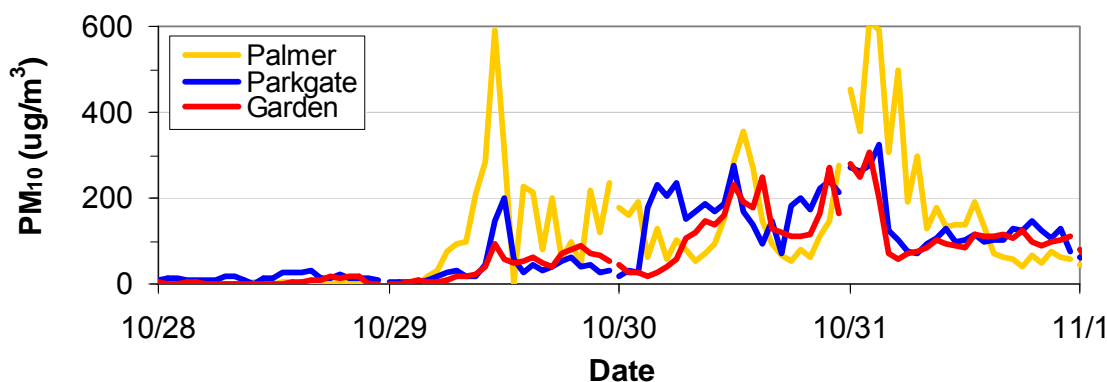
**(B) Eagle River** (weather data = PABV; PM<sub>10</sub> data = Parkgate station)



**(C) Anchorage** (weather data = PANC; PM<sub>10</sub> data = Garden station)



**(D) Detailed progression of PM<sub>10</sub> front from Palmer to Anchorage**



The dry wind and PM<sub>10</sub> front appeared in Eagle River and Anchorage several hours after Palmer (Figure 6-B, C, D). While the size and frequency of PM<sub>10</sub> spikes roughly corresponded to the strength and frequency of the wind gusts at each monitoring station, the peak gusts in Anchorage were less strong than in Palmer, and the multiple sharp PM<sub>10</sub> spikes in Palmer were aggregated into fewer and rounder peaks in Anchorage (Figure 6). This is evidence that dry winds that blew in Palmer area transported the dust downwind to Eagle River and Anchorage. Because airborne particles travel at different speeds due to differences in their physical characteristics, a dust cloud generally spreads across wider area with increasing distance from its emission point. Thus, the fact that the PM<sub>10</sub> peaks in Anchorage were of lower magnitude and less jagged than the peaks observed in Palmer (Figure 6-D) is consistent with the idea that the dust emission source was closer to Palmer than Anchorage.

The wind front (as evidenced by gust speed and relative humidity) was not as distinct in Anchorage as at the upwind monitoring sites, and this pattern was also observed for the PM<sub>10</sub> Front (Figure 6). This is additional evidence that the Matanuska Wind conveyed the PM<sub>10</sub> and consequently was the main factor determining local PM<sub>10</sub> concentrations during the wind storm.

### C. PM<sub>10</sub> concentrations exceeded normal historical fluctuations

The 24-hr PM<sub>10</sub> averages of 163 µg/m<sup>3</sup> observed on October 30, 2009 and 137µg/m<sup>3</sup> on the following day are highly unusual for the Parkgate station. Including the event of October 30, 2009, PM<sub>10</sub> concentrations have exceeded the NAAQS only *three* times in the 17 year period between 1993 and 2009<sup>8</sup>. All of these events have occurred when strong Matanuska winds coincided with snowless conditions. Exceptional events requests have been prepared for both of these previous exceedances. EPA concurrence has been granted for one, the other is pending. (Table 3).

**Table 3. Annual top three PM<sub>10</sub> concentrations at Parkgate station with and without the high wind events (1993- 2009).** Bold letters show the exceedance events.

Year	Sampling Frequency	PM10 (µg/m <sup>3</sup> )					Max gust* (mile/hr)	Exceptional events status
		Without high values caused by high wind			With high values caused by high wind			
		Max	2 <sup>nd</sup> Max	3 <sup>rd</sup> Max	Max	2 <sup>nd</sup> Max		
1993	1 in 6	79	77	76	-	-		
1994	1 in 6	94	60	44	-	-		
1995	1 in 6	60	51	47	-	-		
1996	1 in 6	91	49	45	-	-		
1997	1 in 6	61	59	58	-	-		
1998	1 in 6	59	55	47	-	-		
1999	1 in 6	90	66	38	-	-		
2000	1 in 6	64	53	52	-	-		
2001	1 in 6	69	66	64	-	-		
2002	1 in 6	46	40	38	-	-		
2003	1 in 6	92	75	70	<b>590</b>	-	71	concurrence
2004	1 in 6	70	43	38	-	-		
2005	1 in 6	90	65	51	-	-		
2006	1 in 6	65	60	48	-	-		
2007	1 in 6	48	46	39	<b>223</b>	-	48	Pending concurrence
2008	1 in 6	70	53	47	-	-		
2009	daily	78	74	73	<b>163</b>	137	40	Requested

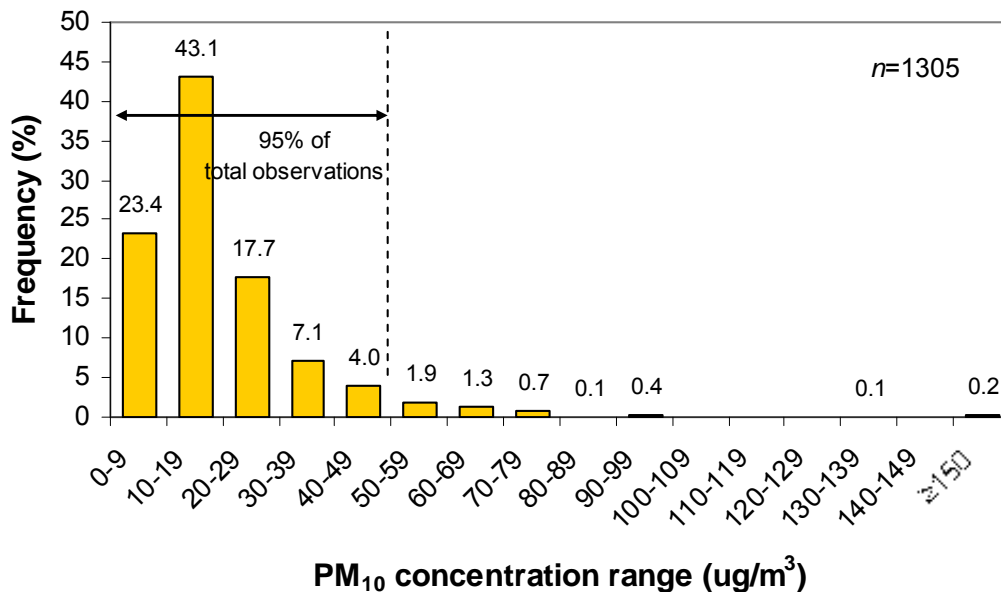
\* The gust data are recorded at PANC (source: NCDC)

<sup>8</sup> We began our analysis with data beginning in 1993 because PM<sub>10</sub> concentrations in prior years were heavily influenced by volcanic eruptions of Mt. Spurr (1992), and Mt. Redoubt (1990).

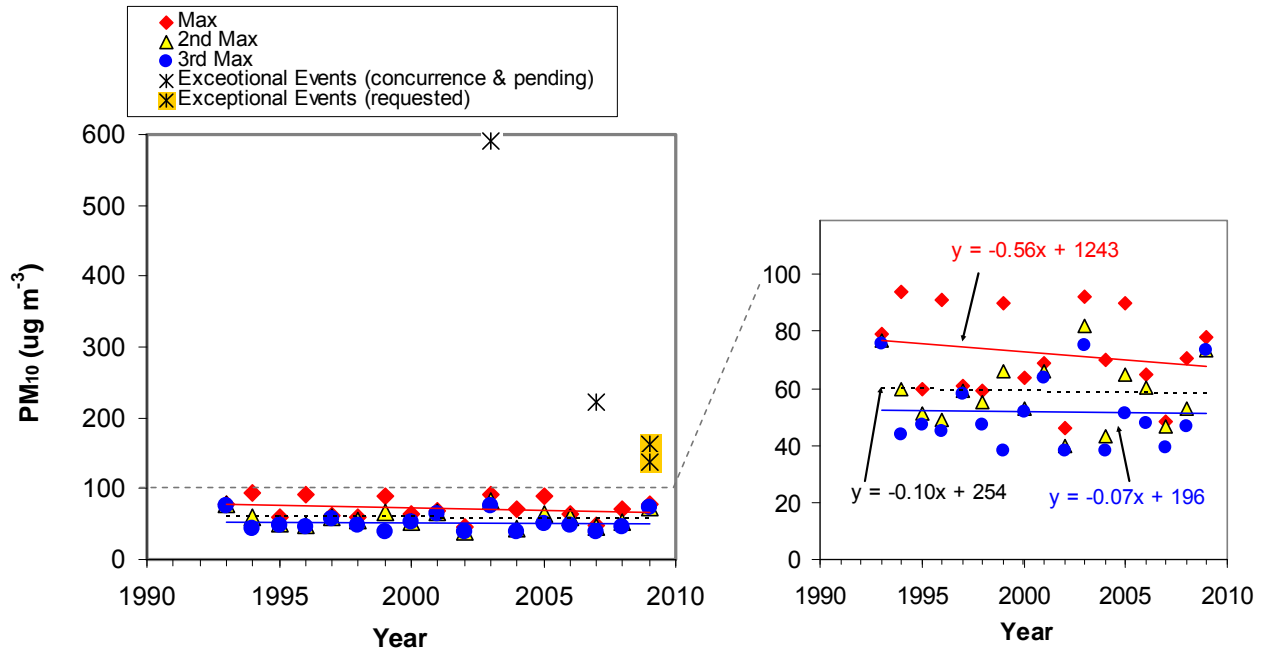
In Figure 7, a frequency distribution of all observations since 1993 ( $n = 1361$ ), including all exceptional events regardless of their exceptional event status (i.e., concurrence, concurrence pending, or request) is shown. The figure indicates that over 95% of the observed  $PM_{10}$  values are less than  $50 \mu\text{g}/\text{m}^3$  and 99.7% were below  $100 \mu\text{g}/\text{m}^3$ . Only 0.2% of all observations have exceeded the NAAQS.

In Figure 8, the highest three  $PM_{10}$  concentrations at Parkgate station that have not been flagged are plotted annually for the 1993-2009 period along with five flagged exceptional events regardless of status (concurrence, pending, and requested). From the graph it is clear that the  $PM_{10}$  values observed on October 30 and 31, along with two earlier exceptional events, are completely outside of the regular variability of the highest  $PM_{10}$  concentrations observed at Parkgate station. Furthermore, when the flagged data points are excluded, there is a general declining trend of highest  $PM_{10}$  concentrations over this period indicated by the negative coefficients of regression lines (Figure 8). This trend suggests that  $PM_{10}$  air quality in Eagle River has improved over the past 17 years. Clearly, the exceedance of October 30, 2009 was not the result of a general deterioration of air quality near the station.

**Figure 7. Frequency distribution of Parkgate  $PM_{10}$  concentrations 1993-2009.**



**Figure 8. Normal variability of high PM<sub>10</sub> vs. wind-caused high PM<sub>10</sub> events at Parkgate station.** The three highest PM<sub>10</sub> concentrations for a 1993-2009 period are plotted separately from the exceptional events of all status (concurrency, pending, and requested). The right graph is a magnified version of the left graph below 100 μg/m<sup>3</sup>. Note the negative slope suggesting improving PM<sub>10</sub> air quality.



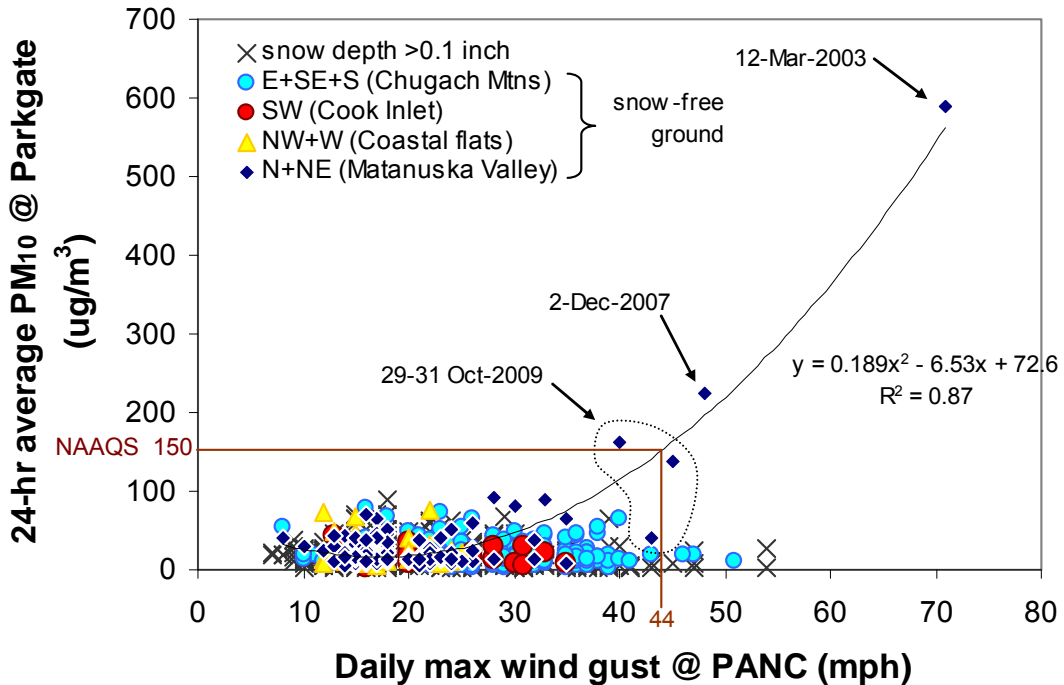
#### D. There would have been no exceedance but for the event

Analysis of historical data reveals a close association between PM<sub>10</sub> concentrations and weather conditions. In Figure 9, all 24-hr PM<sub>10</sub> averages recorded at Parkgate station during the period of 1998-2009 are plotted against the daily maximum gust speed observed at PANC<sup>9</sup>. PM<sub>10</sub> values measured when snow cover was present ( $n=438$ ) 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<sub>10</sub> sample was collected. For example, a red circle indicates that the PM<sub>10</sub> 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<sub>10</sub> emissions, on those days with red circles the contribution of natural sources to PM<sub>10</sub> in Eagle River was minimal.

PM<sub>10</sub> concentrations above 100 μg/m<sup>3</sup> were observed only when N-NE winds of ≥40 mph blew over snow-free ground ( $n=126$ ). Furthermore, with just one exception, PM<sub>10</sub> concentrations at Parkgate have *always* been above 100 μg/m<sup>3</sup> when N-NE winds of ≥40 mph blew over snow-free ground. The only exception was the first day of the wind storm (29 October 2009) that eventually led up to the exceedance. On this particular day, PM<sub>10</sub> was only 41 μg/m<sup>3</sup> even though the maximum gust of that day was 43 mph. The wind started to blow but subsided quickly on this day, resulting in minimal PM<sub>10</sub> transport from Palmer to downwind areas, as reflected by the much smaller PM<sub>10</sub> peaks in Eagle River and Anchorage relative to the Palmer area (Figure 6). These large fluctuations in wind speed likely resulted in the high gust recorded for the day without the consequent high PM<sub>10</sub>.

<sup>9</sup> Complete weather data (from NCDC) that include snow depth on the ground was available only at PANC.

**Figure 9. Relationship between PM<sub>10</sub> concentration at Parkgate station and daily maximum wind gust at PANC with and without snow cover on the ground (1998-2009).**



A regression model for N-NE gust speed and PM<sub>10</sub> concentration explains most variability of PM<sub>10</sub> observed at the Parkgate station ( $R^2=0.87$ ). According to this model, when there is no snow cover, an exceedance of the PM<sub>10</sub> NAAQS is expected at the Parkgate station whenever the maximum gust speed at PANC exceeds 44 mph. If uncertainty of the model is taken into account, under snow-free conditions it is reasonable to predict that the PM<sub>10</sub> 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 N-NE wind ( $\geq 40$  mph at PANC) that blew over snow-free ground, there would have been no exceedance of the PM<sub>10</sub> NAAQS. Without these winds we are highly confident that PM<sub>10</sub> values would have remained well below 100  $\mu\text{g}/\text{m}^3$  on 30 and 31 October 2009.

## 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 (30, 31 October 2009) were flagged upon AQS data submission. We are requesting that EPA exclude both these data points in determining whether the Parkgate site is 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<sub>10</sub> due to future natural events.

A regional network, the Alaska Air Monitoring Network, which includes Anchorage, Eagle River, and the Matanuska-Susitna Valley has allowed access to “real-time” air quality data, including PM<sub>10</sub> since 2008. This network system has made it possible to assess the extent of wind-blown dust and to predict whether PM<sub>10</sub> levels in Eagle River and Anchorage might approach or exceed the NAAQS. During the event on October 30, 2009 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 exceedance on October 30, 2009 and the high PM<sub>10</sub> concentration on the following day were beyond the normal fluctuation of PM<sub>10</sub> concentrations at the Parkgate station, and high PM<sub>10</sub> occurred only when the strong and dry N-NE Matanuska wind was blowing over snow-free ground. It is clear that there would not have been an exceedance on October 30 at the Parkgate station, but 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, thus the exceedance and high PM<sub>10</sub> concentrations of 30 and 31 October 2009 were caused by uncontrollable and unpreventable natural event.

Because wind-blown dust is one of the major natural soil forming processes around Palmer and lower Matanuska Valley area, dust generation 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.<sup>10</sup> A long-term trend of snowmelt timing in western U.S. measured as the amount of snow remaining on the ground on April 1<sup>st</sup> shows that there is on average less snow on the ground that date than there was 50 years ago<sup>11</sup>. Later establishment of snow cover in late fall and earlier snowmelt in early spring in Matanuska Valley and its floodplain would mean greater chances of Matanuska wind to blow over dry and snow-free ground and an increased probability of PM<sub>10</sub> exceedances at the Parkgate station. 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, however.

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<sup>10</sup> 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.

<sup>11</sup> 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 Mat-Su Frontiersman  
&  
Local weather forecast by NWS on 29-Oct-2009**

(Source: [http://www.frontiersman.com/articles/2009/10/29/local\\_news/doc4aea40d7e2740562901359.txt](http://www.frontiersman.com/articles/2009/10/29/local_news/doc4aea40d7e2740562901359.txt))

## Wind causes outages

By ANDREW WELLNER

Frontiersman

Published on *Thursday, October 29, 2009 8:25 PM AKDT*

MAT-SU — Linemen and emergency crews scrambled Thursday afternoon and into the night as high winds caused problems across the Valley.

Lorali Carter with the Matanuska Electric Association said Thursday afternoon that crews were busy putting up downed power lines.

“We have a handful of outages all over the service area due to the wind storms,” she said. “It’s mostly just debris blowing into the power lines.”

As of 4 p.m., she said, there had been 15 outages and there were 700 to 1,000 customers without power in pockets scattered across the utility’s service territory that stretches from Eagle River to Talkeetna.

Over at the Mat-Su Borough, Deputy Director of Emergency Services Clint Vardeman said crews in Palmer and Wasilla were very busy. Mostly it was the same calls MEA responded to. At least one of the downed lines caused a minor grass fire.

“The last time I checked they were talking about gusts in the Wasilla area of about 36,” miles per hour, he said. “I don’t know where they’re reading from, but it’s certainly not where I’m sitting.”

He said another call had to do with a natural gas smell that filled up a house after its power was turned back on.

“So far, knock on wood, everything has been relatively minor, but scary, for the person that sees it or that’s involved with it,” he said.

Contact Andrew Wellner at [andrew.wellner@frontiersman.com](mailto:andrew.wellner@frontiersman.com) or 352-2270.



ROBERT DeBERRY/Frontiersman The windy conditions fill the air with dust blurring the setting sun as it dips below the horizon Thursday evening. The Matanuska-Susitna Borough has issued an air quality warning for the Palmer area until 8 a.m. this morning or until the winds subside.

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(Source: [http://www.frontiersman.com/articles/2009/10/29/breaking\\_news/doc4aea1dc7845af952029978.txt](http://www.frontiersman.com/articles/2009/10/29/breaking_news/doc4aea1dc7845af952029978.txt))

## Air quality alert through Friday morning

By Frontiersman staff

Published on *Thursday, October 29, 2009 2:57 PM AKDT*

PALMER — The Matanuska-Susitna Borough has issued an air quality warning for the Palmer area until 8 a.m. Friday or until the winds subside.

According to the borough’s hotline, air quality is at the unhealthy to very unhealthy level. Children, the elderly and those with heart or lung conditions are advised to stay indoors and limit physical activity. Healthy adults are advised to refrain from strenuous outdoor activity.

The hotline is updated as conditions change. The number is 352-3878.

(Source: <http://pafc.arh.noaa.gov/fcst.php?zone=AKZ111>)

## Local Weather Forecast by NWS

**AKZ111-300000-**

**MATANUSKA VALLEY-**

INCLUDING...PALMER...WASILLA...SUTTON...CHICKALOON

500 AM AKDT THU OCT 29 2009

**...DENSE FOG ADVISORY IS CANCELED...**

**...STRONG WIND THROUGH SATURDAY MORNING...**

**.TODAY...**PARTLY CLOUDY. HIGHS IN THE 30S. NORTHEAST WIND INCREASING TO 15 TO 30 MPH WITH LOCAL GUSTS TO 50 MPH.

**.TONIGHT...**MOSTLY CLEAR. LOWS 15 TO 25. NORTHEAST WIND 10 TO 25 MPH WITH LOCAL GUSTS TO 45 MPH.

**.FRIDAY...**SUNNY. HIGHS IN THE 30S. NORTHEAST WIND 10 TO 25 MPH WITH LOCAL GUSTS TO 45 MPH.

**.FRIDAY NIGHT...**MOSTLY CLEAR. LOWS 15 TO 20. NORTHEAST WIND 15 TO 30 MPH WITH LOCAL GUSTS TO 50 MPH.

**.SATURDAY...**MOSTLY SUNNY. HIGHS IN THE UPPER 20S TO MID 30S. NORTHEAST WIND 15 TO 30 MPH...WITH LOCAL GUSTS TO 45 MPH IN THE MORNING.

**.SATURDAY NIGHT...**PARTLY CLOUDY. LOWS IN THE TEENS.

**.SUNDAY THROUGH MONDAY NIGHT...**PARTLY CLOUDY. HIGHS IN THE 30S. LOWS 15 TO 25.

**.TUESDAY AND TUESDAY NIGHT...**MOSTLY CLOUDY. HIGHS 25 TO 35. LOWS 15 TO 25.

**.WEDNESDAY...**MOSTLY CLOUDY WITH A CHANCE OF SNOW. HIGHS IN THE 30S.

## **Appendix B**

**Air Quality Advisory issued on 30-Oct-2009 by Municipality of Anchorage**

# MUNICIPALITY OF ANCHORAGE



Department of Health and Human Services

907-343-6718

*Mayor Dan Sullivan*

**For immediate release: October 30, 2009**

**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 unhealthy concentrations.

Brisk north winds, low humidity and lack of snow cover are contributing to the dusty conditions. In particular, high winds 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 at least through Friday night.

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.

###

**Prevent. Promote. Protect.**

P.O. Box 196650 • Anchorage, Alaska 99519-6650 • 825 "L" Street • <http://www.muni.org>

## **Appendix C**

**PM<sub>10</sub> and weather data around the wind storm**

## Wind and visibility data of Palmer area (25 Oct – 2 Nov 2009) – Palmer Airport (PAAQ)

Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Site	AK STD Time	Wind direction (degrees)	Wind speed (mph)		Visibility (miles)	Relative humidity (%)
			average	gust		
Palmer	2009/10/25 0:53		0		10	64
Palmer	2009/10/25 1:53		0		10	68
Palmer	2009/10/25 2:53		0		10	74
Palmer	2009/10/25 3:53	350	7		10	74
Palmer	2009/10/25 4:53		0		10	79
Palmer	2009/10/25 5:53		0		10	74
Palmer	2009/10/25 6:53		0		10	80
Palmer	2009/10/25 7:53		0		10	80
Palmer	2009/10/25 8:53		0		10	80
Palmer	2009/10/25 9:53		0		10	86
Palmer	2009/10/25 10:53		0		10	74
Palmer	2009/10/25 11:53		0		10	74
Palmer	2009/10/25 12:53		0		10	64
Palmer	2009/10/25 13:53	150	6		10	74
Palmer	2009/10/25 14:53	210	3		10	74
Palmer	2009/10/25 15:53	100	5		10	80
Palmer	2009/10/25 16:53		0		10	74
Palmer	2009/10/25 17:53		0		10	74
Palmer	2009/10/25 18:53		0		10	74
Palmer	2009/10/25 19:53		0		10	74
Palmer	2009/10/25 20:53		0		10	86
Palmer	2009/10/25 21:53	10	6		10	86
Palmer	2009/10/25 22:53	350	7		10	86
Palmer	2009/10/25 23:53	340	8		10	86
Palmer	2009/10/26 0:53	30	5		10	86
Palmer	2009/10/26 1:53	10	6		10	74
Palmer	2009/10/26 2:53	360	3		10	80
Palmer	2009/10/26 3:53	360	5		10	80
Palmer	2009/10/26 5:53		0		10	80
Palmer	2009/10/26 6:53	350	5		10	86
Palmer	2009/10/26 7:53	350	5		10	86
Palmer	2009/10/26 8:48	340	5		10	86
Palmer	2009/10/26 8:53	340	3		10	86
Palmer	2009/10/26 9:27	350	3		10	86
Palmer	2009/10/26 9:53		0		10	86
Palmer	2009/10/26 10:23	360	6		10	86
Palmer	2009/10/26 10:53	340	5		10	86
Palmer	2009/10/26 11:41	340	5		10	86
Palmer	2009/10/26 11:53	340	6		10	86
Palmer	2009/10/26 12:53	350	3		9.1	86
Palmer	2009/10/26 13:53	340	3		10	86
Palmer	2009/10/26 14:53	10	3		10	86
Palmer	2009/10/26 15:36		0		10	86
Palmer	2009/10/26 15:53		0		10	86
Palmer	2009/10/26 16:40		0		10	80
Palmer	2009/10/26 16:50	230	3		10	86
Palmer	2009/10/26 16:53	250	3		10	93
Palmer	2009/10/26 17:38	250	7		10	93
Palmer	2009/10/26 17:53	240	5		9.1	93
Palmer	2009/10/26 18:29	250	3		10	93
Palmer	2009/10/26 18:53		0		9.1	93
Palmer	2009/10/26 19:08		0		10	93
Palmer	2009/10/26 19:53	990	3		10	93
Palmer	2009/10/26 20:53		0		7	93
Palmer	2009/10/26 21:53	300	3		7	93
Palmer	2009/10/26 22:35	50	5		7	93
Palmer	2009/10/26 22:53	50	3		10	93
Palmer	2009/10/26 23:53	30	3		10	93
Palmer	2009/10/27 0:08		0		10	93
Palmer	2009/10/27 0:53	10	5		10	93
Palmer	2009/10/27 1:53	340	3		10	93
Palmer	2009/10/27 2:09		0		10	93
Palmer	2009/10/27 2:29	360	3		10	93
Palmer	2009/10/27 2:38	10	5		10	93
Palmer	2009/10/27 2:53	360	5		10	93
Palmer	2009/10/27 3:53	10	8		10	86
Palmer	2009/10/27 4:01	10	8		10	86
Palmer	2009/10/27 4:53	360	6		10	93

Palmer	2009/10/27 5:39	350	5		10	86
Palmer	2009/10/27 5:53	350	6		10	93
Palmer	2009/10/27 6:46	350	5		10	93
Palmer	2009/10/27 6:53	350	6		10	93
Palmer	2009/10/27 7:53	340	6		10	86
Palmer	2009/10/27 8:53	340	3		10	86
Palmer	2009/10/27 9:53	340	3		10	93
Palmer	2009/10/27 10:21	350	3		10	93
Palmer	2009/10/27 10:53	10	3		8	93
Palmer	2009/10/27 11:23	10	3		10	93
Palmer	2009/10/27 11:53		0		10	93
Palmer	2009/10/27 12:53		0		10	86
Palmer	2009/10/27 13:53		0		10	86
Palmer	2009/10/27 14:53		0		10	86
Palmer	2009/10/27 15:53		0		10	80
Palmer	2009/10/27 16:53		0		10	80
Palmer	2009/10/27 17:30		0		10	74
Palmer	2009/10/27 17:53		0		10	80
Palmer	2009/10/27 18:53		0		10	93
Palmer	2009/10/27 19:53		0		10	86
Palmer	2009/10/27 20:39		0		1.8	93
Palmer	2009/10/27 20:53		0		7	86
Palmer	2009/10/27 21:53		0		10	93
Palmer	2009/10/27 22:53		0		10	86
Palmer	2009/10/27 23:19		0		8	86
Palmer	2009/10/27 23:27		0		8	86
Palmer	2009/10/27 23:39		0		9.1	86
Palmer	2009/10/27 23:53		0		10	86
Palmer	2009/10/28 0:53	350	6		10	92
Palmer	2009/10/28 1:38	350	3		10	92
Palmer	2009/10/28 1:53	350	3		10	92
Palmer	2009/10/28 2:53	340	3		10	86
Palmer	2009/10/28 3:53	360	3		10	92
Palmer	2009/10/28 4:53		0		10	86
Palmer	2009/10/28 5:53		0		10	92
Palmer	2009/10/28 6:53		0		10	92
Palmer	2009/10/28 7:53		0		10	92
Palmer	2009/10/28 8:34		0		1.8	100
Palmer	2009/10/28 8:49		0		1.5	92
Palmer	2009/10/28 8:53		0		1.5	92
Palmer	2009/10/28 9:01		0		3	92
Palmer	2009/10/28 9:20		0		7	92
Palmer	2009/10/28 9:53		0		4	92
Palmer	2009/10/28 10:00		0		2.5	92
Palmer	2009/10/28 10:08		0		1	92
Palmer	2009/10/28 10:20		0		0.5	92
Palmer	2009/10/28 10:30		0		1	100
Palmer	2009/10/28 10:45		0		0.3	100
Palmer	2009/10/28 10:53		0		0.3	100
Palmer	2009/10/28 11:23		0		0.3	100
Palmer	2009/10/28 11:53		0		0.3	100
Palmer	2009/10/28 12:07		0		0.5	100
Palmer	2009/10/28 12:18		0		1	100
Palmer	2009/10/28 12:24		0		3	92
Palmer	2009/10/28 12:53		0		10	92
Palmer	2009/10/28 13:53		0		10	92
Palmer	2009/10/28 14:53	140	3		10	92
Palmer	2009/10/28 15:53	150	3		10	80
Palmer	2009/10/28 16:53		0		10	80
Palmer	2009/10/28 17:53	200	5		9.1	86
Palmer	2009/10/28 18:00	240	5		2	92
Palmer	2009/10/28 18:01	220	6		0.8	92
Palmer	2009/10/28 18:05	220	5		0.3	92
Palmer	2009/10/28 18:16	230	3		0.3	92
Palmer	2009/10/28 18:27	240	6		0.3	100
Palmer	2009/10/28 18:36	200	3		0.5	92
Palmer	2009/10/28 18:53	110	3		0.3	92
Palmer	2009/10/28 19:53		0		0.3	92
Palmer	2009/10/28 20:53		0		0.3	92
Palmer	2009/10/28 21:53	180	3		0.3	100
Palmer	2009/10/28 22:53		0		0.3	92
Palmer	2009/10/28 23:53		0		0.3	92
Palmer	2009/10/29 0:53		0		0.3	86

Palmer	2009/10/29 1:53			0		0.3	92
Palmer	2009/10/29 2:46	990		3		0.3	85
Palmer	2009/10/29 2:49	990		3		0.3	85
Palmer	2009/10/29 2:53	990		5		0.5	85
Palmer	2009/10/29 3:02	170		6		0.8	85
Palmer	2009/10/29 3:09	40		6		2.5	92
Palmer	2009/10/29 3:16	990		6	19	10	86
Palmer	2009/10/29 3:53	30		21	28	10	68
Palmer	2009/10/29 4:53	20		25	40	10	63
Palmer	2009/10/29 5:53	30		29	41	10	50
Palmer	2009/10/29 6:53	20		31	41	10	47
Palmer	2009/10/29 7:53	20		25	44	10	47
Palmer	2009/10/29 8:53	20		30	40	10	43
Palmer	2009/10/29 9:53	10		31	43	10	40
Palmer	2009/10/29 10:53	20		29	47	10	34
Palmer	2009/10/29 11:53	20		32	40	10	37
Palmer	2009/10/29 12:53	30		29	44	10	40
Palmer	2009/10/29 13:53	30		32	51	10	40
Palmer	2009/10/29 14:53	40		25	39	10	30
Palmer	2009/10/29 15:53	50		25	41	10	25
Palmer	2009/10/29 16:53	40		24	43	10	29
Palmer	2009/10/29 17:53	50		25	39	4	29
Palmer	2009/10/29 18:11	40		33	43	2.5	29
Palmer	2009/10/29 18:20	40		31	43	5	29
Palmer	2009/10/29 18:53	40		26	34	10	29
Palmer	2009/10/29 19:53	40		19	39	5	29
Palmer	2009/10/29 20:53	30		31	45	10	32
Palmer	2009/10/29 21:24	40		32	47	2.5	27
Palmer	2009/10/29 21:33	50		25	44	5	29
Palmer	2009/10/29 21:53	50		19	38	4	29
Palmer	2009/10/29 22:14	40		32	41	2.5	32
Palmer	2009/10/29 22:25	30		25	47	5	32
Palmer	2009/10/29 22:53	30		23	39	8	34
Palmer	2009/10/29 23:53	40		24	46	6	31
Palmer	2009/10/30 0:53	30		37	51	5	31
Palmer	2009/10/30 1:53	30		32	47	5	31
Palmer	2009/10/30 2:53	40		24	32	4	31
Palmer	2009/10/30 3:13	30		30	44	3	31
Palmer	2009/10/30 3:53	30		36	45	7	31
Palmer	2009/10/30 4:53	20		25	37	10	34
Palmer	2009/10/30 5:53	20		31	43	9.1	31
Palmer	2009/10/30 6:53	30		22	36	10	34
Palmer	2009/10/30 7:53	20		22	33	10	34
Palmer	2009/10/30 8:53	20		21	38	10	31
Palmer	2009/10/30 9:53	20		28	37	10	34
Palmer	2009/10/30 10:53	20		24	36	8	31
Palmer	2009/10/30 11:53	20		24	38	10	29
Palmer	2009/10/30 12:53	10		29	41	8	29
Palmer	2009/10/30 13:53	20		30	48	8	27
Palmer	2009/10/30 14:53	20		29	47	7	25
Palmer	2009/10/30 16:53	20		23	33	10	29
Palmer	2009/10/30 17:53	30		21	31	8	31
Palmer	2009/10/30 18:53	30		19	30	10	31
Palmer	2009/10/30 19:53	30		19	40	10	29
Palmer	2009/10/30 20:53	20		25	36	10	29
Palmer	2009/10/30 21:53	20		26	37	10	28
Palmer	2009/10/30 22:53	20		32	45	7	30
Palmer	2009/10/30 23:53	30		39	53	7	30
Palmer	2009/10/31 0:53	20		33	47	10	30
Palmer	2009/10/31 1:53	20		33	52	8	30
Palmer	2009/10/31 2:53	30		34	56	4	30
Palmer	2009/10/31 3:53	30		41	55	6	30
Palmer	2009/10/31 4:53	30		43	62	7	30
Palmer	2009/10/31 5:53	30		46	62	7	30
Palmer	2009/10/31 6:53	20		38	54	5	32
Palmer	2009/10/31 7:53	30		37	48	10	30
Palmer	2009/10/31 8:53	30		33	52	7	30
Palmer	2009/10/31 9:53	30		37	51	6	30
Palmer	2009/10/31 10:53	40		31	46	7	28
Palmer	2009/10/31 11:53	30		32	51	6	28
Palmer	2009/10/31 12:20	40		38	51	1.8	26
Palmer	2009/10/31 12:30	40		33	49	5	26
Palmer	2009/10/31 12:53	40		33	49	5	26

Palmer	2009/10/31 13:53	40	30	47	4	24
Palmer	2009/10/31 14:53	40	25	38	9.1	24
Palmer	2009/10/31 15:53	40	25	36	7	24
Palmer	2009/10/31 16:53	30	29	38	7	28
Palmer	2009/10/31 17:53	30	24	36	6	30
Palmer	2009/10/31 18:53	20	23	43	8	30
Palmer	2009/10/31 19:53	30	25	33	9.1	30
Palmer	2009/10/31 20:53	30	26	34	10	30
Palmer	2009/10/31 21:53	50	22	33	10	30
Palmer	2009/10/31 22:53	40	17	30	10	30
Palmer	2009/10/31 23:53	40	21	33	10	30
Palmer	2009/11/1 0:53	50	11	28	10	30
Palmer	2009/11/1 1:53	50	11	25	10	30
Palmer	2009/11/1 2:53	990	7		10	38
Palmer	2009/11/1 3:53	60	8		10	35
Palmer	2009/11/1 4:53	30	9		10	35
Palmer	2009/11/1 5:53	30	8		10	38
Palmer	2009/11/1 6:53	40	11	22	10	35
Palmer	2009/11/1 7:53		0		10	62
Palmer	2009/11/1 8:53	10	6		10	67
Palmer	2009/11/1 9:53		0		10	67
Palmer	2009/11/1 10:53		0		10	57
Palmer	2009/11/1 11:53		0		10	49
Palmer	2009/11/1 12:53		0		10	57
Palmer	2009/11/1 13:53		0		10	49
Palmer	2009/11/1 14:53		0		10	50
Palmer	2009/11/1 15:53		0		10	50
Palmer	2009/11/1 16:53		0		10	49
Palmer	2009/11/1 17:53		0		10	53
Palmer	2009/11/1 18:53		0		10	62
Palmer	2009/11/1 19:53		0		10	67
Palmer	2009/11/1 20:53		0		10	67
Palmer	2009/11/1 21:53		0		10	72
Palmer	2009/11/1 22:53		0		10	72
Palmer	2009/11/1 23:53		0		10	67
Palmer	2009/11/2 0:53	30	3		10	78
Palmer	2009/11/2 1:53		0		10	72
Palmer	2009/11/2 2:53	20	5		10	72
Palmer	2009/11/2 3:53		0		10	78
Palmer	2009/11/2 4:53		0		10	78
Palmer	2009/11/2 5:53		0		10	78
Palmer	2009/11/2 6:53		0		10	78
Palmer	2009/11/2 8:53		0		10	78
Palmer	2009/11/2 9:53		0		10	85
Palmer	2009/11/2 10:53		0		10	78
Palmer	2009/11/2 11:53		0		10	79
Palmer	2009/11/2 12:53	150	5		10	79
Palmer	2009/11/2 13:53	160	3		10	68
Palmer	2009/11/2 14:53		0		10	58
Palmer	2009/11/2 15:53		0		10	58
Palmer	2009/11/2 16:53		0		10	53
Palmer	2009/11/2 17:53		0		10	62
Palmer	2009/11/2 18:53		0		10	72
Palmer	2009/11/2 19:53		0		10	73
Palmer	2009/11/2 20:53	350	6		10	57
Palmer	2009/11/2 21:53	340	6		10	57
Palmer	2009/11/2 22:53	350	8		10	57
Palmer	2009/11/2 23:53	350	8		10	48

## Wind and visibility data of Palmer area (25 Oct – 2 Nov 2009) – Birchwood Airport (PAVB)

Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Site	AK STD Time	Wind direction (degrees)	Wind speed (mph)		Visibility (miles)	Relative humidity (%)
			average	gust		
Birchwood	2009/10/25 0:00	150	3		10	69
Birchwood	2009/10/25 0:16	140	3		10	74
Birchwood	2009/10/25 0:36		0		10	69
Birchwood	2009/10/25 1:00		0		10	69
Birchwood	2009/10/25 1:16		0		10	69
Birchwood	2009/10/25 1:36	120	3		10	74
Birchwood	2009/10/25 2:00		0		10	74
Birchwood	2009/10/25 2:16	200	3		10	80
Birchwood	2009/10/25 2:36	190	3		10	80
Birchwood	2009/10/25 3:00	150	3		10	74
Birchwood	2009/10/25 3:16		0		10	74
Birchwood	2009/10/25 3:36		0		10	80
Birchwood	2009/10/25 4:00		0		10	80
Birchwood	2009/10/25 4:16	180	3		10	80
Birchwood	2009/10/25 4:36	170	3		10	80
Birchwood	2009/10/25 5:00	180	3		10	80
Birchwood	2009/10/25 5:16		0		10	80
Birchwood	2009/10/25 5:36		0		10	80
Birchwood	2009/10/25 6:00		0		10	80
Birchwood	2009/10/25 6:16		0		10	80
Birchwood	2009/10/25 6:36		0		10	80
Birchwood	2009/10/25 7:00		0		10	86
Birchwood	2009/10/25 7:16	170	5		10	80
Birchwood	2009/10/25 7:36		0		10	74
Birchwood	2009/10/25 8:00	200	5		10	80
Birchwood	2009/10/25 8:16	200	5		10	74
Birchwood	2009/10/25 8:36		0		10	80
Birchwood	2009/10/25 9:00	200	5		10	74
Birchwood	2009/10/25 9:16	190	6		10	74
Birchwood	2009/10/25 9:36	190	6		10	74
Birchwood	2009/10/25 10:00	200	6		10	74
Birchwood	2009/10/25 10:16	200	5		10	74
Birchwood	2009/10/25 10:36	190	7		10	74
Birchwood	2009/10/25 11:00		0		10	69
Birchwood	2009/10/25 11:16		0		10	69
Birchwood	2009/10/25 11:36		0		10	69
Birchwood	2009/10/25 12:00		0		10	69
Birchwood	2009/10/25 12:16		0		10	69
Birchwood	2009/10/25 12:36		0		10	69
Birchwood	2009/10/25 13:00		0		10	69
Birchwood	2009/10/25 13:16	250	3		10	69
Birchwood	2009/10/25 13:36	250	3		10	69
Birchwood	2009/10/25 14:00	210	7		10	69
Birchwood	2009/10/25 14:16	220	8		10	69
Birchwood	2009/10/25 14:36	270	5		10	69
Birchwood	2009/10/25 15:00	250	6		10	69
Birchwood	2009/10/25 15:16	220	7		10	64
Birchwood	2009/10/25 15:36	230	5		10	64
Birchwood	2009/10/25 16:00	240	6		10	69
Birchwood	2009/10/25 16:16	230	7		10	69
Birchwood	2009/10/25 16:36	240	5		10	69
Birchwood	2009/10/25 17:00	220	7		10	69
Birchwood	2009/10/25 17:16	230	8		10	64
Birchwood	2009/10/25 17:36	230	6		10	64
Birchwood	2009/10/25 18:00	220	8		10	64
Birchwood	2009/10/25 18:16	200	8		10	69
Birchwood	2009/10/25 18:36	210	8		10	69
Birchwood	2009/10/25 19:00	210	8		10	69
Birchwood	2009/10/25 19:16	200	7		10	69
Birchwood	2009/10/25 19:36	200	8		10	69
Birchwood	2009/10/25 20:00	200	7		10	69
Birchwood	2009/10/25 20:16	200	8		10	64
Birchwood	2009/10/25 20:36	40	5		10	69
Birchwood	2009/10/25 21:00	100	3		10	74
Birchwood	2009/10/25 21:16		0		10	74
Birchwood	2009/10/25 21:36		0		10	74
Birchwood	2009/10/25 22:00		0		10	74
Birchwood	2009/10/25 22:16	70	3		10	74

Birchwood	2009/10/25 22:36		0		10	74
Birchwood	2009/10/25 23:00	60	3		10	74
Birchwood	2009/10/25 23:36	60	5		10	74
Birchwood	2009/10/26 0:00	50	6		10	74
Birchwood	2009/10/26 0:16	80	3		10	74
Birchwood	2009/10/26 0:36	90	5		10	74
Birchwood	2009/10/26 1:00	70	3		10	80
Birchwood	2009/10/26 1:16	70	5		10	74
Birchwood	2009/10/26 1:36	60	3		10	69
Birchwood	2009/10/26 2:00	60	5		10	74
Birchwood	2009/10/26 2:16		0		10	74
Birchwood	2009/10/26 2:36		0		10	69
Birchwood	2009/10/26 3:00		0		10	74
Birchwood	2009/10/26 3:16	50	5		10	74
Birchwood	2009/10/26 3:36		0		10	74
Birchwood	2009/10/26 4:00		0		10	80
Birchwood	2009/10/26 4:16		0		10	80
Birchwood	2009/10/26 5:16		0		10	80
Birchwood	2009/10/26 5:36		0		10	80
Birchwood	2009/10/26 6:00		0		10	80
Birchwood	2009/10/26 6:16	70	5		10	80
Birchwood	2009/10/26 6:36		0		10	80
Birchwood	2009/10/26 7:00		0		10	74
Birchwood	2009/10/26 7:16		0		10	80
Birchwood	2009/10/26 7:36		0		10	74
Birchwood	2009/10/26 8:00	60	5		10	74
Birchwood	2009/10/26 8:16	50	3		10	74
Birchwood	2009/10/26 8:36		0		10	80
Birchwood	2009/10/26 9:00		0		10	80
Birchwood	2009/10/26 9:16		0		10	80
Birchwood	2009/10/26 9:36	60	5		10	74
Birchwood	2009/10/26 10:00	50	5		10	80
Birchwood	2009/10/26 10:16	50	3		10	80
Birchwood	2009/10/26 10:36		0		10	86
Birchwood	2009/10/26 11:00	60	3		10	80
Birchwood	2009/10/26 11:16		0		10	80
Birchwood	2009/10/26 11:36		0		10	80
Birchwood	2009/10/26 12:00		0		10	86
Birchwood	2009/10/26 12:16	210	7		10	75
Birchwood	2009/10/26 12:36	220	8		10	75
Birchwood	2009/10/26 13:00	220	7		10	75
Birchwood	2009/10/26 13:16	220	8		10	75
Birchwood	2009/10/26 13:36	220	6		10	75
Birchwood	2009/10/26 14:00	210	8		10	80
Birchwood	2009/10/26 14:16	220	8		10	80
Birchwood	2009/10/26 14:36	220	7		10	80
Birchwood	2009/10/26 15:00	210	10		10	80
Birchwood	2009/10/26 15:16	200	10		10	80
Birchwood	2009/10/26 15:36	200	10		10	86
Birchwood	2009/10/26 16:00	200	11		10	86
Birchwood	2009/10/26 16:16	190	8		10	80
Birchwood	2009/10/26 16:36	200	7		10	74
Birchwood	2009/10/26 17:00	210	6		10	80
Birchwood	2009/10/26 17:16	220	5		6	80
Birchwood	2009/10/26 17:36	220	6		9.1	80
Birchwood	2009/10/26 18:00	230	3		10	86
Birchwood	2009/10/26 18:16	220	7		8	80
Birchwood	2009/10/26 18:36	210	6		10	80
Birchwood	2009/10/26 19:00	220	5		10	80
Birchwood	2009/10/26 19:16		0		10	80
Birchwood	2009/10/26 19:36	230	3		10	86
Birchwood	2009/10/26 20:00		0		10	86
Birchwood	2009/10/26 20:16		0		10	93
Birchwood	2009/10/26 20:36	210	5		10	80
Birchwood	2009/10/26 21:00	210	6		10	80
Birchwood	2009/10/26 21:16	220	5		10	86
Birchwood	2009/10/26 21:36	260	3		10	86
Birchwood	2009/10/26 22:00		0		10	80
Birchwood	2009/10/26 22:16		0		10	80
Birchwood	2009/10/26 22:36		0		10	86
Birchwood	2009/10/26 23:00		0		10	80
Birchwood	2009/10/26 23:16		0		10	80
Birchwood	2009/10/26 23:36		0		10	80

Birchwood	2009/10/27 0:00		0		10	93
Birchwood	2009/10/27 0:16		0		10	80
Birchwood	2009/10/27 0:36		0		10	80
Birchwood	2009/10/27 1:00		0		10	86
Birchwood	2009/10/27 1:16		0		10	80
Birchwood	2009/10/27 1:36	120	3		10	86
Birchwood	2009/10/27 2:00		0		10	86
Birchwood	2009/10/27 2:16		0		10	80
Birchwood	2009/10/27 2:36		0		10	80
Birchwood	2009/10/27 3:00	70	3		10	80
Birchwood	2009/10/27 3:16	70	3		10	80
Birchwood	2009/10/27 3:36		0		10	80
Birchwood	2009/10/27 4:00		0		10	80
Birchwood	2009/10/27 4:16		0		10	80
Birchwood	2009/10/27 4:36		0		10	80
Birchwood	2009/10/27 5:00		0		10	86
Birchwood	2009/10/27 5:16		0		10	80
Birchwood	2009/10/27 5:36	200	6		10	80
Birchwood	2009/10/27 6:00	210	9		10	80
Birchwood	2009/10/27 6:16	210	7		10	80
Birchwood	2009/10/27 6:36	210	6		10	80
Birchwood	2009/10/27 7:00	220	5		10	80
Birchwood	2009/10/27 7:16	230	5		10	80
Birchwood	2009/10/27 7:36		0		10	80
Birchwood	2009/10/27 8:00		0		10	80
Birchwood	2009/10/27 8:16		0		10	80
Birchwood	2009/10/27 8:36				10	80
Birchwood	2009/10/27 9:00		0		10	80
Birchwood	2009/10/27 9:16		0		10	86
Birchwood	2009/10/27 9:36		0		10	80
Birchwood	2009/10/27 10:00	210	5		10	80
Birchwood	2009/10/27 10:16	220	5		9.1	80
Birchwood	2009/10/27 10:36	190	5		10	80
Birchwood	2009/10/27 11:00	230	5		9.1	86
Birchwood	2009/10/27 11:16	230	5		10	80
Birchwood	2009/10/27 11:36	220	3		10	80
Birchwood	2009/10/27 12:00	220	5		10	80
Birchwood	2009/10/27 12:16		0		10	80
Birchwood	2009/10/27 12:36		0		10	80
Birchwood	2009/10/27 13:00		0		10	86
Birchwood	2009/10/27 13:16		0		10	80
Birchwood	2009/10/27 13:36		0		10	86
Birchwood	2009/10/27 14:00		0		10	74
Birchwood	2009/10/27 14:16		0		10	80
Birchwood	2009/10/27 14:36		0		10	80
Birchwood	2009/10/27 15:00		0		10	74
Birchwood	2009/10/27 15:16		0		10	74
Birchwood	2009/10/27 15:36		0		10	74
Birchwood	2009/10/27 16:00		0		10	74
Birchwood	2009/10/27 16:16		0		10	74
Birchwood	2009/10/27 16:36		0		10	74
Birchwood	2009/10/27 17:00		0		10	74
Birchwood	2009/10/27 17:16		0		10	74
Birchwood	2009/10/27 17:36		0		10	74
Birchwood	2009/10/27 18:00		0		10	74
Birchwood	2009/10/27 18:16		0		10	74
Birchwood	2009/10/27 18:36		0		10	80
Birchwood	2009/10/27 19:00		0		10	80
Birchwood	2009/10/27 19:16		0		10	80
Birchwood	2009/10/27 19:36		0		10	80
Birchwood	2009/10/27 20:00		0		10	80
Birchwood	2009/10/27 20:16		0		10	86
Birchwood	2009/10/27 20:36		0		10	86
Birchwood	2009/10/27 21:00		0		10	86
Birchwood	2009/10/27 21:16		0		10	86
Birchwood	2009/10/27 21:36	130	3		10	86
Birchwood	2009/10/27 22:00		0		10	86
Birchwood	2009/10/27 22:16		0		10	86
Birchwood	2009/10/27 22:36		0		10	86
Birchwood	2009/10/27 23:00		0		10	80
Birchwood	2009/10/27 23:16		0		10	86
Birchwood	2009/10/27 23:36		0		10	86
Birchwood	2009/10/28 0:00		0		10	86

Birchwood	2009/10/28 0:16		0		10	80
Birchwood	2009/10/28 0:36		0		10	80
Birchwood	2009/10/28 1:00		0		10	86
Birchwood	2009/10/28 1:16		0		9.1	86
Birchwood	2009/10/28 1:36		0		9.1	86
Birchwood	2009/10/28 2:00		0		8	86
Birchwood	2009/10/28 2:16		0		10	86
Birchwood	2009/10/28 2:36		0		10	86
Birchwood	2009/10/28 3:00		0		6	93
Birchwood	2009/10/28 3:16		0		3	86
Birchwood	2009/10/28 3:36		0		5	86
Birchwood	2009/10/28 4:00		0		7	86
Birchwood	2009/10/28 4:16		0		10	86
Birchwood	2009/10/28 4:36		0		5	93
Birchwood	2009/10/28 5:00		0		10	86
Birchwood	2009/10/28 5:16		0		10	86
Birchwood	2009/10/28 5:36		0		9.1	86
Birchwood	2009/10/28 6:00		0		7	86
Birchwood	2009/10/28 6:16		0		8	86
Birchwood	2009/10/28 6:36		0		8	86
Birchwood	2009/10/28 7:00		0		8	86
Birchwood	2009/10/28 7:16		0		10	86
Birchwood	2009/10/28 7:36		0		10	80
Birchwood	2009/10/28 8:00		0		10	80
Birchwood	2009/10/28 8:16		0		10	86
Birchwood	2009/10/28 8:36		0		10	86
Birchwood	2009/10/28 9:16		0		9.1	80
Birchwood	2009/10/28 9:36	190	3		10	80
Birchwood	2009/10/28 10:00		0		10	86
Birchwood	2009/10/28 10:16		0		10	86
Birchwood	2009/10/28 10:36		0		10	86
Birchwood	2009/10/28 11:00	30	3		10	86
Birchwood	2009/10/28 11:16		0		10	86
Birchwood	2009/10/28 11:36	60	3		10	86
Birchwood	2009/10/28 12:00	30	3		9.1	86
Birchwood	2009/10/28 12:16	40	6		10	86
Birchwood	2009/10/28 12:36	40	5		10	86
Birchwood	2009/10/28 13:00	40	3		10	86
Birchwood	2009/10/28 13:16	40	3		10	86
Birchwood	2009/10/28 13:36		0		10	86
Birchwood	2009/10/28 14:00	360	3		10	86
Birchwood	2009/10/28 14:16		0		9.1	86
Birchwood	2009/10/28 14:36		0		10	86
Birchwood	2009/10/28 15:00		0		10	80
Birchwood	2009/10/28 15:16		0		10	86
Birchwood	2009/10/28 15:36		0		10	80
Birchwood	2009/10/28 16:00	220	3		10	86
Birchwood	2009/10/28 16:16	200	5		10	86
Birchwood	2009/10/28 16:36	190	7		10	86
Birchwood	2009/10/28 17:00	210	7		10	80
Birchwood	2009/10/28 17:16	210	6		10	80
Birchwood	2009/10/28 17:36	200	6		10	80
Birchwood	2009/10/28 18:00	190	6		10	80
Birchwood	2009/10/28 18:16	190	6		10	86
Birchwood	2009/10/28 18:36	200	6		10	86
Birchwood	2009/10/28 19:00	200	3		10	86
Birchwood	2009/10/28 19:16	180	3		10	80
Birchwood	2009/10/28 19:36	200	5		10	86
Birchwood	2009/10/28 20:00	200	6		10	86
Birchwood	2009/10/28 20:16	190	5		10	86
Birchwood	2009/10/28 20:36	190	6		10	86
Birchwood	2009/10/28 21:00	190	5		10	86
Birchwood	2009/10/28 21:16	180	5		10	86
Birchwood	2009/10/28 21:36	150	5		10	86
Birchwood	2009/10/28 22:00	170	3		10	86
Birchwood	2009/10/28 22:16	180	3		10	86
Birchwood	2009/10/28 22:36	190	7		10	86
Birchwood	2009/10/28 23:00	210	8		10	86
Birchwood	2009/10/28 23:16	210	8		10	86
Birchwood	2009/10/28 23:36	200	9		10	86
Birchwood	2009/10/29 0:00	210	8		10	86
Birchwood	2009/10/29 0:16	210	8		10	86
Birchwood	2009/10/29 0:36	200	7		10	92

Birchwood	2009/10/29 1:00	200	8		10	86
Birchwood	2009/10/29 1:16	200	8		10	86
Birchwood	2009/10/29 1:36	200	7		10	86
Birchwood	2009/10/29 2:00	210	8		10	86
Birchwood	2009/10/29 2:16	210	8		10	79
Birchwood	2009/10/29 2:36	210	6		10	79
Birchwood	2009/10/29 3:00	210	6		10	79
Birchwood	2009/10/29 3:16	210	7		10	79
Birchwood	2009/10/29 3:36	200	6		10	79
Birchwood	2009/10/29 4:00	210	7		10	79
Birchwood	2009/10/29 4:16	220	6		10	79
Birchwood	2009/10/29 4:36	210	8		10	79
Birchwood	2009/10/29 5:00	200	8		10	79
Birchwood	2009/10/29 5:16	190	7		10	73
Birchwood	2009/10/29 5:36	210	5		10	79
Birchwood	2009/10/29 6:00	240	6		10	79
Birchwood	2009/10/29 6:16	220	6		10	79
Birchwood	2009/10/29 6:36	200	6		10	79
Birchwood	2009/10/29 7:00	210	8		10	73
Birchwood	2009/10/29 7:16	70	3		10	68
Birchwood	2009/10/29 7:36	50	10	19	10	55
Birchwood	2009/10/29 8:00	50	13	18	10	51
Birchwood	2009/10/29 8:16	50	13	19	10	47
Birchwood	2009/10/29 8:36	50	14	26	10	47
Birchwood	2009/10/29 9:00	50	16	23	10	43
Birchwood	2009/10/29 9:16	50	18	25	10	40
Birchwood	2009/10/29 9:36	50	16	21	10	40
Birchwood	2009/10/29 10:00	60	15	24	10	37
Birchwood	2009/10/29 10:16	60	15	28	10	37
Birchwood	2009/10/29 10:36	60	19	25	8	37
Birchwood	2009/10/29 11:00	60	22	29	9.1	40
Birchwood	2009/10/29 11:16	60	16	31	9.1	40
Birchwood	2009/10/29 11:36	50	22	32	10	40
Birchwood	2009/10/29 12:00	70	18	26	8	40
Birchwood	2009/10/29 12:16	60	14	19	9.1	38
Birchwood	2009/10/29 12:36	60	22	33	9.1	38
Birchwood	2009/10/29 13:00	60	23	32	10	38
Birchwood	2009/10/29 13:16	60	23	30	9.1	38
Birchwood	2009/10/29 13:36	60	22	29	10	38
Birchwood	2009/10/29 14:00	60	23	30	10	38
Birchwood	2009/10/29 14:16	60	21	34	10	38
Birchwood	2009/10/29 14:36	50	18	28	10	38
Birchwood	2009/10/29 15:00	50	17	26	10	38
Birchwood	2009/10/29 15:16	50	21	28	10	38
Birchwood	2009/10/29 15:36	60	18	30	10	38
Birchwood	2009/10/29 16:00	40	23	31	10	38
Birchwood	2009/10/29 16:16	50	18	29	10	38
Birchwood	2009/10/29 16:36	40	21	31	10	32
Birchwood	2009/10/29 17:00	60	18	30	10	30
Birchwood	2009/10/29 17:16	50	21	28	10	32
Birchwood	2009/10/29 17:36	50	15	28	10	32
Birchwood	2009/10/29 18:00	50	16	23	10	32
Birchwood	2009/10/29 18:16	50	13		10	32
Birchwood	2009/10/29 18:36	50	14	19	10	32
Birchwood	2009/10/29 19:00	50	10	16	10	29
Birchwood	2009/10/29 19:16	50	11		10	34
Birchwood	2009/10/29 19:36	50	11		10	34
Birchwood	2009/10/29 20:00	50	9		10	34
Birchwood	2009/10/29 20:16	50	10		10	34
Birchwood	2009/10/29 20:36	50	13	22	10	34
Birchwood	2009/10/29 21:00	60	16	23	10	32
Birchwood	2009/10/29 21:16	70	13	22	10	32
Birchwood	2009/10/29 21:36	60	14	18	10	32
Birchwood	2009/10/29 22:00	60	22	26	10	32
Birchwood	2009/10/29 22:16	50	21	26	8	34
Birchwood	2009/10/29 22:36	50	18	29	7	32
Birchwood	2009/10/29 23:00	80	15	23	7	32
Birchwood	2009/10/29 23:16	60	16	26	8	32
Birchwood	2009/10/29 23:36	60	17	24	7	32
Birchwood	2009/10/30 0:00	50	28	33	8	32
Birchwood	2009/10/30 0:16	60	22	34	7	32
Birchwood	2009/10/30 0:36	60	22	28	7	32
Birchwood	2009/10/30 1:00	50	22	31	7	29

Birchwood	2009/10/30 1:16	50	22	26	7	29
Birchwood	2009/10/30 1:36	50	19	26	7	31
Birchwood	2009/10/30 2:00	40	21	28	7	31
Birchwood	2009/10/30 2:16	60	19	29	10	31
Birchwood	2009/10/30 2:36	70	17	26	10	31
Birchwood	2009/10/30 3:00	60	18	26	8	31
Birchwood	2009/10/30 3:16	50	17	23	10	31
Birchwood	2009/10/30 3:36	50	16	23	9.1	31
Birchwood	2009/10/30 4:00	60	17	29	5	31
Birchwood	2009/10/30 4:16	60	18	29	5	31
Birchwood	2009/10/30 4:36	60	19	28	6	31
Birchwood	2009/10/30 5:00	60	23	30	8	31
Birchwood	2009/10/30 5:16	60	18	34	7	31
Birchwood	2009/10/30 5:36	80	22	33	6	31
Birchwood	2009/10/30 6:00	70	16	28	7	31
Birchwood	2009/10/30 6:16	70	16	28	7	31
Birchwood	2009/10/30 6:36	60	17	28	8	31
Birchwood	2009/10/30 7:00	70	15	26	8	31
Birchwood	2009/10/30 7:16	50	22	30	8	31
Birchwood	2009/10/30 7:36	50	16	26	8	31
Birchwood	2009/10/30 8:00	60	17	23	9.1	31
Birchwood	2009/10/30 8:16	50	23	30	8	34
Birchwood	2009/10/30 8:36	70	21	31	10	31
Birchwood	2009/10/30 8:45	170	7		6	
Birchwood	2009/10/30 9:00	60	22	26	10	31
Birchwood	2009/10/30 9:16	60	16	24	9.1	31
Birchwood	2009/10/30 9:36	60	19	24	10	34
Birchwood	2009/10/30 10:00	60	16	24	10	34
Birchwood	2009/10/30 10:16	70	17	24	10	34
Birchwood	2009/10/30 10:36	60	17	23	8	29
Birchwood	2009/10/30 11:00	50	24	37	6	34
Birchwood	2009/10/30 11:16	50	23	36	9.1	34
Birchwood	2009/10/30 11:36	70	11	18	7	29
Birchwood	2009/10/30 12:00	60	16	23	6	29
Birchwood	2009/10/30 12:16	60	16	29	6	29
Birchwood	2009/10/30 12:36	50	23	29	6	29
Birchwood	2009/10/30 13:00	50	22	34	6	31
Birchwood	2009/10/30 13:16	50	25	34	7	31
Birchwood	2009/10/30 13:36	60	22	34	10	31
Birchwood	2009/10/30 14:00	60	23	33	10	31
Birchwood	2009/10/30 14:16	50	24	33	10	31
Birchwood	2009/10/30 14:36	60	18	36	10	31
Birchwood	2009/10/30 15:00	60	25	31	10	29
Birchwood	2009/10/30 16:00	50	25	38	10	29
Birchwood	2009/10/30 16:16	50	29	40	10	29
Birchwood	2009/10/30 16:36	50	25	40	10	29
Birchwood	2009/10/30 17:00	50	23	34	9.1	29
Birchwood	2009/10/30 17:16	50	23	36	10	29
Birchwood	2009/10/30 17:36	60	25	37	10	31
Birchwood	2009/10/30 18:00	60	24	36	10	29
Birchwood	2009/10/30 18:16	50	28	37	10	29
Birchwood	2009/10/30 18:36	50	26	34	10	29
Birchwood	2009/10/30 19:00	60	25	39	10	29
Birchwood	2009/10/30 19:16	50	26	37	10	29
Birchwood	2009/10/30 21:00	60	16		****	
Birchwood	2009/10/30 21:16	60	23	32	10	26
Birchwood	2009/10/30 21:36	60	21	32	10	31
Birchwood	2009/10/30 22:00	60	22	33	10	29
Birchwood	2009/10/30 22:16	60	22	39	10	29
Birchwood	2009/10/30 22:36	50	22	33	10	31
Birchwood	2009/10/30 23:00	50	24	38	10	31
Birchwood	2009/10/30 23:16	70	26	39	10	31
Birchwood	2009/10/30 23:36	60	24	37	10	29
Birchwood	2009/10/31 0:00	70	22	33	10	31
Birchwood	2009/10/31 0:16	60	22	29	10	28
Birchwood	2009/10/31 0:36	50	25	34	10	28
Birchwood	2009/10/31 1:00	60	23	37	7	28
Birchwood	2009/10/31 1:16	60	21	34	6	30
Birchwood	2009/10/31 1:36	50	25	34	7	30
Birchwood	2009/10/31 2:00	50	24	34	8	30
Birchwood	2009/10/31 2:16	60	28	33	7	30
Birchwood	2009/10/31 2:36	60	29	37	7	30
Birchwood	2009/10/31 3:00	50	22	33	5	30

Birchwood	2009/10/31 3:16	60	19	33	5	30
Birchwood	2009/10/31 3:36	50	21	34	7	30
Birchwood	2009/10/31 4:00	50	26	37	8	30
Birchwood	2009/10/31 4:16	60	26	38	9.1	28
Birchwood	2009/10/31 4:36	60	24	37	9.1	28
Birchwood	2009/10/31 5:00	60	24	33	8	28
Birchwood	2009/10/31 5:16	60	19	28	7	28
Birchwood	2009/10/31 5:36	70	22	28	7	28
Birchwood	2009/10/31 6:00	50	23	32	7	30
Birchwood	2009/10/31 6:16	70	19	25	9.1	30
Birchwood	2009/10/31 6:36	60	26	34	9.1	30
Birchwood	2009/10/31 7:00	50	23	32	10	28
Birchwood	2009/10/31 7:16	50	21	30	10	28
Birchwood	2009/10/31 7:36	50	21	29	10	28
Birchwood	2009/10/31 8:00	50	22		10	28
Birchwood	2009/10/31 8:16	40	18	30	10	28
Birchwood	2009/10/31 8:36	50	21	31	10	28
Birchwood	2009/10/31 9:00	50	17	24	10	30
Birchwood	2009/10/31 9:16	60	14	25	7	30
Birchwood	2009/10/31 9:36	50	13		7	30
Birchwood	2009/10/31 10:00	50	15	19	10	30
Birchwood	2009/10/31 10:16	50	11	19	10	33
Birchwood	2009/10/31 10:36	60	11	25	10	33
Birchwood	2009/10/31 11:00	50	15	24	10	30
Birchwood	2009/10/31 11:16	50	16	25	10	30
Birchwood	2009/10/31 11:36	60	13	21	10	30
Birchwood	2009/10/31 12:00	70	14		10	30
Birchwood	2009/10/31 12:16	90	7		10	28
Birchwood	2009/10/31 12:36	60	11	18	10	28
Birchwood	2009/10/31 13:00	70	17	23	9.1	24
Birchwood	2009/10/31 13:16	50	15	22	10	26
Birchwood	2009/10/31 13:36	60	14	23	10	24
Birchwood	2009/10/31 14:00	60	13	22	10	24
Birchwood	2009/10/31 14:16	50	19	25	10	26
Birchwood	2009/10/31 14:36	50	17	21	10	26
Birchwood	2009/10/31 15:00	70	14	19	10	26
Birchwood	2009/10/31 15:16	50	13		10	26
Birchwood	2009/10/31 15:36	70	10		10	24
Birchwood	2009/10/31 16:00	60	9		10	24
Birchwood	2009/10/31 16:16	70	6		10	24
Birchwood	2009/10/31 16:36	70	6		10	24
Birchwood	2009/10/31 17:00	50	5		10	26
Birchwood	2009/10/31 17:16	60	7		10	26
Birchwood	2009/10/31 17:36		0		10	36
Birchwood	2009/10/31 18:00	110	5		10	36
Birchwood	2009/10/31 18:16	140	6		10	39
Birchwood	2009/10/31 18:36	100	6		10	39
Birchwood	2009/10/31 19:00	110	7		10	36
Birchwood	2009/10/31 19:16	120	5		10	42
Birchwood	2009/10/31 19:36	130	6		10	38
Birchwood	2009/10/31 20:00	120	6		10	38
Birchwood	2009/10/31 20:16	130	5		10	38
Birchwood	2009/10/31 20:36	120	6		10	41
Birchwood	2009/10/31 21:00	120	3		10	41
Birchwood	2009/10/31 21:16		0		10	41
Birchwood	2009/10/31 21:36		0		10	48
Birchwood	2009/10/31 22:00		0		10	49
Birchwood	2009/10/31 22:16	140	3		10	53
Birchwood	2009/10/31 22:36	120	5		10	53
Birchwood	2009/10/31 23:00	120	3		10	49
Birchwood	2009/10/31 23:16		0		10	53
Birchwood	2009/10/31 23:36		0		10	57
Birchwood	2009/11/1 0:00		0		10	57
Birchwood	2009/11/1 0:16		0		10	57
Birchwood	2009/11/1 0:36		0		10	57
Birchwood	2009/11/1 1:00		0		10	62
Birchwood	2009/11/1 1:16		0		10	62
Birchwood	2009/11/1 1:36		0		10	57
Birchwood	2009/11/1 2:00		0		10	62
Birchwood	2009/11/1 2:16		0		10	57
Birchwood	2009/11/1 2:36	140	3		10	61
Birchwood	2009/11/1 3:00	140	3		10	57
Birchwood	2009/11/1 3:16		0		10	62

Birchwood	2009/11/1 3:36		0		10	62
Birchwood	2009/11/1 4:00	150	3		10	62
Birchwood	2009/11/1 4:16	150	3		10	67
Birchwood	2009/11/1 4:36		0		10	57
Birchwood	2009/11/1 5:00		0		10	62
Birchwood	2009/11/1 5:16		0		10	62
Birchwood	2009/11/1 5:36		0		10	62
Birchwood	2009/11/1 6:00		0		10	62
Birchwood	2009/11/1 6:16	150	3		10	67
Birchwood	2009/11/1 6:36		0		10	67
Birchwood	2009/11/1 7:00		0		10	67
Birchwood	2009/11/1 7:16		0		10	67
Birchwood	2009/11/1 7:36	150	3		10	67
Birchwood	2009/11/1 8:00		0		10	67
Birchwood	2009/11/1 8:16	150	3		10	67
Birchwood	2009/11/1 8:36		0		10	72
Birchwood	2009/11/1 9:00	200	6		10	67
Birchwood	2009/11/1 9:16	150	3		10	67
Birchwood	2009/11/1 9:36	130	5		10	67
Birchwood	2009/11/1 10:00	130	3		10	67
Birchwood	2009/11/1 10:16	180	3		10	67
Birchwood	2009/11/1 10:36		0		10	67
Birchwood	2009/11/1 11:00		0		10	72
Birchwood	2009/11/1 11:16	180	3		10	67
Birchwood	2009/11/1 11:36	210	6		10	62
Birchwood	2009/11/1 12:00	200	3		10	62
Birchwood	2009/11/1 12:16	200	7		10	57
Birchwood	2009/11/1 12:36	210	6		10	53
Birchwood	2009/11/1 13:00	230	3		10	49
Birchwood	2009/11/1 13:16	230	3		10	49
Birchwood	2009/11/1 13:36	220	3		10	49
Birchwood	2009/11/1 14:00	280	3		10	49
Birchwood	2009/11/1 14:16	250	3		10	49
Birchwood	2009/11/1 14:36		0		10	42
Birchwood	2009/11/1 15:00		0		10	39
Birchwood	2009/11/1 15:16	210	3		10	42
Birchwood	2009/11/1 15:36	200	5		10	42
Birchwood	2009/11/1 16:00	220	5		10	46
Birchwood	2009/11/1 16:16	210	3		10	42
Birchwood	2009/11/1 16:36		0		10	46
Birchwood	2009/11/1 17:00	210	6		10	46
Birchwood	2009/11/1 17:16	220	6		10	42
Birchwood	2009/11/1 17:36	190	7		10	42
Birchwood	2009/11/1 18:00	180	5		10	45
Birchwood	2009/11/1 18:16	170	5		10	45
Birchwood	2009/11/1 18:36	140	3		10	49
Birchwood	2009/11/1 19:00	120	5		10	49
Birchwood	2009/11/1 19:16	120	6		10	53
Birchwood	2009/11/1 19:36	120	6		10	62
Birchwood	2009/11/2 8:36		0		10	78
Birchwood	2009/11/2 9:00	90	3		10	78
Birchwood	2009/11/2 9:16		0		10	78
Birchwood	2009/11/2 9:36		0		10	72
Birchwood	2009/11/2 10:00		0		10	72
Birchwood	2009/11/2 10:36		0		10	78
Birchwood	2009/11/2 11:00	120	3		10	78
Birchwood	2009/11/2 11:16	100	5		10	72
Birchwood	2009/11/2 11:36		0		10	72
Birchwood	2009/11/2 12:00		0		10	73
Birchwood	2009/11/2 12:16		0		10	67
Birchwood	2009/11/2 12:36	50	3		10	62
Birchwood	2009/11/2 13:00		0		10	62
Birchwood	2009/11/2 13:36		0		10	63
Birchwood	2009/11/2 14:00	50	5		10	63
Birchwood	2009/11/2 14:16	40	3		10	63
Birchwood	2009/11/2 14:36	40	6		10	58
Birchwood	2009/11/2 15:00	50	6		10	58
Birchwood	2009/11/2 15:16	40	5		10	58
Birchwood	2009/11/2 15:36	50	3		10	58
Birchwood	2009/11/2 16:00	40	3		10	58
Birchwood	2009/11/2 16:16		0		10	63
Birchwood	2009/11/2 16:36	60	5		10	58
Birchwood	2009/11/2 17:00	50	5		10	53

Birchwood	2009/11/2 17:16		0		10	53
Birchwood	2009/11/2 17:36	100	3		10	49
Birchwood	2009/11/2 18:00	120	5		10	53
Birchwood	2009/11/2 18:16	130	5		10	57
Birchwood	2009/11/2 18:36	120	6		10	53
Birchwood	2009/11/2 19:00	120	5		10	57
Birchwood	2009/11/2 19:16	130	5		10	57
Birchwood	2009/11/2 19:36		0		10	62
Birchwood	2009/11/2 20:00		0		10	67
Birchwood	2009/11/2 20:16		0		9.1	67
Birchwood	2009/11/2 20:36		0		10	67
Birchwood	2009/11/2 21:00		0		10	67
Birchwood	2009/11/2 21:16	130	3		10	67
Birchwood	2009/11/2 21:36		0		10	66
Birchwood	2009/11/2 22:00		0		10	67
Birchwood	2009/11/2 22:16		0		10	66
Birchwood	2009/11/2 22:36		0		10	78
Birchwood	2009/11/2 23:00		0		10	78
Birchwood	2009/11/2 23:16		0		10	78
Birchwood	2009/11/2 23:36	160	3		10	78

## Wind and visibility data of Palmer area (25 Oct – 2 Nov 2009) – Anchorage International Airport (PANC)

Source: NCDC Quality Controlled Local Climatological Data (DS3505)

Site	AK STD Time	Wind direction (degrees)	Wind speed (mph)		Visibility (miles)	Relative humidity (%)
			average	gust		
Anchorage	2009/10/25 0:53		0		10	74
Anchorage	2009/10/25 1:53	340	6		10	69
Anchorage	2009/10/25 2:53		0		10	74
Anchorage	2009/10/25 3:53	360	3		10	69
Anchorage	2009/10/25 4:00	360	3		10	72
Anchorage	2009/10/25 4:53		0		10	74
Anchorage	2009/10/25 5:53	70	3		10	74
Anchorage	2009/10/25 6:53	20	5		10	74
Anchorage	2009/10/25 7:53	30	6		10	74
Anchorage	2009/10/25 8:53	20	6		10	69
Anchorage	2009/10/25 9:53	20	6		10	60
Anchorage	2009/10/25 10:00	20	6		10	61
Anchorage	2009/10/25 10:53		0		10	69
Anchorage	2009/10/25 11:53	20	5		10	55
Anchorage	2009/10/25 12:53	50	3		10	60
Anchorage	2009/10/25 13:53		0		10	60
Anchorage	2009/10/25 14:53		0		10	60
Anchorage	2009/10/25 15:53		0		10	60
Anchorage	2009/10/25 16:00		0		10	59
Anchorage	2009/10/25 16:53		0		10	64
Anchorage	2009/10/25 17:53		0		10	64
Anchorage	2009/10/25 18:53	210	5		10	64
Anchorage	2009/10/25 19:53	200	8		10	69
Anchorage	2009/10/25 20:53	190	9		10	69
Anchorage	2009/10/25 21:53	190	10		10	69
Anchorage	2009/10/25 22:00	190	10		10	67
Anchorage	2009/10/25 22:53	180	8		10	69
Anchorage	2009/10/25 23:53	190	10		10	65
Anchorage	2009/10/26 0:53	190	10	29	10	65
Anchorage	2009/10/26 1:53	190	9		10	60
Anchorage	2009/10/26 2:53	170	7		10	75
Anchorage	2009/10/26 3:53	180	5		10	70
Anchorage	2009/10/26 4:00	180	5		10	70
Anchorage	2009/10/26 5:53	200	6		10	75
Anchorage	2009/10/26 6:53	190	9		10	70
Anchorage	2009/10/26 7:53	200	7		10	75
Anchorage	2009/10/26 8:53	200	6		10	80
Anchorage	2009/10/26 9:53	200	8		10	75
Anchorage	2009/10/26 10:00	200	8		10	73
Anchorage	2009/10/26 10:53	200	7		10	75
Anchorage	2009/10/26 11:53	220	9		10	75
Anchorage	2009/10/26 12:53	210	9		10	75
Anchorage	2009/10/26 13:53	200	8		10	80
Anchorage	2009/10/26 14:53	200	10		8	80
Anchorage	2009/10/26 15:53	200	8		7	80
Anchorage	2009/10/26 16:00	200	8		6.9	81
Anchorage	2009/10/26 16:53	200	7		5	86
Anchorage	2009/10/26 17:53	200	9		4	86
Anchorage	2009/10/26 18:53	190	8		10	80
Anchorage	2009/10/26 19:53	990	3		10	86
Anchorage	2009/10/26 20:32	200	6		10	74
Anchorage	2009/10/26 20:53	180	8		10	74
Anchorage	2009/10/26 21:27	170	7		10	74
Anchorage	2009/10/26 21:53	180	10	18	8	74
Anchorage	2009/10/26 22:00	180	10		7.5	78
Anchorage	2009/10/26 22:14	180	9		9.1	80
Anchorage	2009/10/26 22:40	180	11	19	10	80
Anchorage	2009/10/26 22:53	190	11		8	80
Anchorage	2009/10/26 23:53	200	9		10	86
Anchorage	2009/10/27 0:53	180	8	23	9.1	86
Anchorage	2009/10/27 1:53	200	6		10	86
Anchorage	2009/10/27 2:53	260	5		4	86
Anchorage	2009/10/27 3:53	280	3		10	86
Anchorage	2009/10/27 4:00	280	3		10	88
Anchorage	2009/10/27 4:53		0		10	93
Anchorage	2009/10/27 5:48		0		10	93
Anchorage	2009/10/27 5:53		0		9.1	93

Anchorage	2009/10/27 6:53		0		7	86
Anchorage	2009/10/27 7:13		0		9.1	86
Anchorage	2009/10/27 7:53		0		10	86
Anchorage	2009/10/27 8:37		0		10	93
Anchorage	2009/10/27 8:53		0		10	93
Anchorage	2009/10/27 9:53		0		3	86
Anchorage	2009/10/27 10:00		0		3	85
Anchorage	2009/10/27 10:44	10	3		6	86
Anchorage	2009/10/27 10:53	30	3		6	86
Anchorage	2009/10/27 11:48	60	6		6	86
Anchorage	2009/10/27 11:53	60	5		6	86
Anchorage	2009/10/27 12:23	70	3		10	86
Anchorage	2009/10/27 12:53	90	5		10	80
Anchorage	2009/10/27 13:31		0		10	80
Anchorage	2009/10/27 13:53	120	3		10	80
Anchorage	2009/10/27 14:53		0		10	69
Anchorage	2009/10/27 15:53	60	3		10	64
Anchorage	2009/10/27 16:00	60	3		10	66
Anchorage	2009/10/27 16:53	30	3		10	64
Anchorage	2009/10/27 17:53		0		10	69
Anchorage	2009/10/27 18:53		0		10	80
Anchorage	2009/10/27 19:53		0		10	80
Anchorage	2009/10/27 20:53		0		10	86
Anchorage	2009/10/27 21:53	50	5		10	74
Anchorage	2009/10/27 22:00	50	5		10	78
Anchorage	2009/10/27 22:53	60	5		10	74
Anchorage	2009/10/27 23:53	60	5		10	80
Anchorage	2009/10/28 0:33	40	3		10	80
Anchorage	2009/10/28 0:53	360	7		10	80
Anchorage	2009/10/28 1:53	20	8		10	80
Anchorage	2009/10/28 2:00	10	7		10	80
Anchorage	2009/10/28 2:12	10	8		10	80
Anchorage	2009/10/28 2:21	20	7		6	86
Anchorage	2009/10/28 2:53	360	8		6	86
Anchorage	2009/10/28 3:23	350	7		10	86
Anchorage	2009/10/28 3:53	360	6		10	86
Anchorage	2009/10/28 4:00	360	6		10	88
Anchorage	2009/10/28 4:53	360	7		4	86
Anchorage	2009/10/28 5:53	10	6		10	86
Anchorage	2009/10/28 6:18	360	6		10	86
Anchorage	2009/10/28 6:33	10	7		6	86
Anchorage	2009/10/28 6:53	10	6		3	86
Anchorage	2009/10/28 7:11	360	7		5	86
Anchorage	2009/10/28 7:53	10	7		9.1	86
Anchorage	2009/10/28 8:00	10	7		8	86
Anchorage	2009/10/28 8:53	360	5		6	86
Anchorage	2009/10/28 9:10	360	8		5	86
Anchorage	2009/10/28 9:53	360	5		10	86
Anchorage	2009/10/28 10:00	360	5		10	88
Anchorage	2009/10/28 10:53	360	8		9.1	80
Anchorage	2009/10/28 11:53	10	6		10	80
Anchorage	2009/10/28 12:53	360	6		10	80
Anchorage	2009/10/28 13:53	360	9		10	80
Anchorage	2009/10/28 14:53	350	9		10	80
Anchorage	2009/10/28 15:53	340	11		10	80
Anchorage	2009/10/28 16:00	340	11		10	81
Anchorage	2009/10/28 16:53	10	8		10	74
Anchorage	2009/10/28 17:53	10	8		10	80
Anchorage	2009/10/28 18:53	30	5		10	80
Anchorage	2009/10/28 19:53	30	7		10	80
Anchorage	2009/10/28 20:53	30	6		10	86
Anchorage	2009/10/28 21:53	20	7		10	80
Anchorage	2009/10/28 22:00	20	7		10	78
Anchorage	2009/10/28 22:53	360	14		10	74
Anchorage	2009/10/28 23:53	20	13	18	10	68
Anchorage	2009/10/29 0:53	360	14		10	68
Anchorage	2009/10/29 1:53	360	17	24	10	63
Anchorage	2009/10/29 2:53	350	16	25	10	68
Anchorage	2009/10/29 3:53	340	15	25	10	68
Anchorage	2009/10/29 4:00	340	15		10	66
Anchorage	2009/10/29 4:53	350	21	33	10	63
Anchorage	2009/10/29 5:53	350	21	29	10	63
Anchorage	2009/10/29 6:53	350	17	26	10	63

Anchorage	2009/10/29 7:53	350	17	30	10	63
Anchorage	2009/10/29 8:53	340	17	30	10	63
Anchorage	2009/10/29 9:53	350	18	28	10	54
Anchorage	2009/10/29 10:00	350	18		10	55
Anchorage	2009/10/29 10:53	360	21	31	10	50
Anchorage	2009/10/29 11:53	350	19	29	10	55
Anchorage	2009/10/29 12:53	360	22	30	10	44
Anchorage	2009/10/29 13:53	20	25	34	10	38
Anchorage	2009/10/29 14:53	30	15	28	10	41
Anchorage	2009/10/29 15:53	20	23	31	10	41
Anchorage	2009/10/29 16:00	20	23		10	40
Anchorage	2009/10/29 16:53	50	8		10	47
Anchorage	2009/10/29 17:53	40	9		10	44
Anchorage	2009/10/29 18:53	170	5		10	59
Anchorage	2009/10/29 19:53	170	6		10	69
Anchorage	2009/10/29 20:53	180	5		10	80
Anchorage	2009/10/29 21:53		0		10	63
Anchorage	2009/10/29 22:00		0		10	65
Anchorage	2009/10/29 22:53	360	3		10	54
Anchorage	2009/10/29 23:53	20	13		10	43
Anchorage	2009/10/30 0:53	40	8		10	40
Anchorage	2009/10/30 1:53	10	16	24	10	43
Anchorage	2009/10/30 2:53	40	9		10	40
Anchorage	2009/10/30 3:53	40	19	36	10	40
Anchorage	2009/10/30 4:00	40	19		10	41
Anchorage	2009/10/30 4:53	30	18	28	10	40
Anchorage	2009/10/30 5:53	360	15	26	10	47
Anchorage	2009/10/30 6:53	340	19	30	10	54
Anchorage	2009/10/30 7:53	360	22	30	10	46
Anchorage	2009/10/30 8:53	350	23	32	10	54
Anchorage	2009/10/30 9:53	360	17	23	10	50
Anchorage	2009/10/30 10:00	360	17		10	48
Anchorage	2009/10/30 10:53	350	17	28	10	54
Anchorage	2009/10/30 11:53	350	18	28	10	50
Anchorage	2009/10/30 12:53	350	15		10	43
Anchorage	2009/10/30 13:10	10	16	30	10	40
Anchorage	2009/10/30 13:23	10	22	31	10	34
Anchorage	2009/10/30 13:53	30	23	36	10	29
Anchorage	2009/10/30 14:53	30	23	36	10	32
Anchorage	2009/10/30 16:00	30	21		10	31
Anchorage	2009/10/30 16:53	10	18	32	10	37
Anchorage	2009/10/30 17:53	10	15	28	10	31
Anchorage	2009/10/30 18:53	10	17	33	10	37
Anchorage	2009/10/30 19:53	40	21	29	10	29
Anchorage	2009/10/30 20:53	30	22	32	10	37
Anchorage	2009/10/30 21:53	10	15	26	10	34
Anchorage	2009/10/30 22:00	10	15		10	34
Anchorage	2009/10/30 22:53	360	15	31	10	34
Anchorage	2009/10/30 23:53	360	23	33	10	34
Anchorage	2009/10/31 0:53	340	18	32	10	42
Anchorage	2009/10/31 1:53	20	26	40	10	36
Anchorage	2009/10/31 2:53	30	28	41	10	33
Anchorage	2009/10/31 3:53	20	24	39	10	33
Anchorage	2009/10/31 4:00	20	24		10	34
Anchorage	2009/10/31 4:53	40	17	29	10	36
Anchorage	2009/10/31 5:53	360	14	25	10	36
Anchorage	2009/10/31 6:53	30	21	31	10	36
Anchorage	2009/10/31 7:53	20	19	33	10	36
Anchorage	2009/10/31 8:53	50	6	16	10	33
Anchorage	2009/10/31 9:53	360	19	26	10	42
Anchorage	2009/10/31 10:00	360	19		10	43
Anchorage	2009/10/31 10:53	30	5		10	45
Anchorage	2009/10/31 11:53	30	15	22	10	36
Anchorage	2009/10/31 12:53	30	11	23	10	31
Anchorage	2009/10/31 13:53	30	8		10	36
Anchorage	2009/10/31 14:53	990	3		10	40
Anchorage	2009/10/31 15:53		0		10	43
Anchorage	2009/10/31 16:00		0		10	44
Anchorage	2009/10/31 16:53	10	6		10	33
Anchorage	2009/10/31 17:53	340	8		10	36
Anchorage	2009/10/31 18:53		0		10	49
Anchorage	2009/10/31 19:53	70	3		10	68
Anchorage	2009/10/31 20:53		0		10	58

Anchorage	2009/10/31 21:53	10	6		10	49
Anchorage	2009/10/31 22:00	10	6		10	52
Anchorage	2009/10/31 22:53	350	8		10	42
Anchorage	2009/10/31 23:53	350	10		10	49
Anchorage	2009/11/1 0:53	340	9		10	49
Anchorage	2009/11/1 1:53	360	11		10	49
Anchorage	2009/11/1 2:53	360	14		10	49
Anchorage	2009/11/1 3:53	360	13		10	49
Anchorage	2009/11/1 4:00	360	13		10	49
Anchorage	2009/11/1 4:53	10	11		10	49
Anchorage	2009/11/1 5:53	350	15		10	49
Anchorage	2009/11/1 6:53	360	15		10	49
Anchorage	2009/11/1 7:53	360	14		10	53
Anchorage	2009/11/1 8:53	360	14		10	53
Anchorage	2009/11/1 9:53	350	14		10	53
Anchorage	2009/11/1 10:00	350	14		10	51
Anchorage	2009/11/1 10:53	360	11		10	53
Anchorage	2009/11/1 11:53	360	10		10	45
Anchorage	2009/11/1 12:53	360	8		10	42
Anchorage	2009/11/1 13:53	10	9		10	39
Anchorage	2009/11/1 14:53	360	11		10	33
Anchorage	2009/11/1 15:53	360	10		10	36
Anchorage	2009/11/1 16:00	360	10		10	35
Anchorage	2009/11/1 16:53	360	8		10	36
Anchorage	2009/11/1 17:53	10	9		10	39
Anchorage	2009/11/1 18:53	20	7		10	42
Anchorage	2009/11/1 19:53	30	7		10	42
Anchorage	2009/11/1 20:53	10	9		10	42
Anchorage	2009/11/1 21:53	20	8		10	45
Anchorage	2009/11/1 22:00	20	8		10	47
Anchorage	2009/11/1 22:53	60	6		10	53
Anchorage	2009/11/1 23:53	40	5		10	57
Anchorage	2009/11/2 0:53	360	6		10	49
Anchorage	2009/11/2 1:53	10	6		10	49
Anchorage	2009/11/2 2:53		0		10	67
Anchorage	2009/11/2 3:53	160	3		10	72
Anchorage	2009/11/2 4:00	160	3		10	73
Anchorage	2009/11/2 4:53		0		10	67
Anchorage	2009/11/2 5:53		0		10	57
Anchorage	2009/11/2 6:53	180	3		10	62
Anchorage	2009/11/2 8:53		0		10	72
Anchorage	2009/11/2 9:53	330	5		10	72
Anchorage	2009/11/2 10:00	330	5		10	73
Anchorage	2009/11/2 10:53	160	3		10	78
Anchorage	2009/11/2 11:53	990	3		10	62
Anchorage	2009/11/2 12:53	300	5		10	62
Anchorage	2009/11/2 13:53	990	3		10	49
Anchorage	2009/11/2 14:53	990	3		10	63
Anchorage	2009/11/2 15:53	320	3		10	53
Anchorage	2009/11/2 16:00	320	3		10	54
Anchorage	2009/11/2 16:53		0		10	53
Anchorage	2009/11/2 17:53		0		10	58
Anchorage	2009/11/2 18:53		0		10	62
Anchorage	2009/11/2 19:53		0		10	62
Anchorage	2009/11/2 20:53		0		10	72
Anchorage	2009/11/2 21:53		0		10	72
Anchorage	2009/11/2 22:00		0		10	73
Anchorage	2009/11/2 22:53		0		10	72
Anchorage	2009/11/2 23:53		0		10	72