

## **Attachment 4**

### **Analysis of Eielson PM-2.5 Monitoring Report**

The Eielson Air Force Base (Eielson) ambient air and meteorological monitoring program was conducted by the U.S. Department of the Air Force (USAF) during 2004 and 2005. The primary purpose of the program was to collect meteorological and ambient air quality data at Eielson, located near North Pole, Alaska, in order to establish a database that could be used in the event that a Prevention of Significant Deterioration (PSD) air permit might be required for future construction or expansion activities.

The dataset for the Eielson ambient air and meteorological monitoring program consists of meteorological data collected from July 1, 2004 through June 30, 2005, gaseous ambient air data were collected from August 1, 2004 through July 31, 2005, and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) samples were collected from October 1, 2004 through September 30, 2005. The PM<sub>10</sub> and PM<sub>2.5</sub> monitoring was done according to the 3-day and 6-day sampling schedule adopted by EPA for the National Ambient Monitoring Stations (NAMS) network and the State/Local Ambient Monitoring Systems (SLAMS) network. Co-located PM<sub>10</sub> and PM<sub>2.5</sub> samples for the determination of method precision were collected on the 6-day sample schedule.

Figure 1 and Figure 2 provide graphs of the 24-hour average PM<sub>10</sub> and PM<sub>2.5</sub> measurements collected throughout the monitoring year. The first and second highest PM<sub>10</sub> concentrations were 188  $\mu\text{g}/\text{m}^3$  measured on August 20, 2005 and 145  $\mu\text{g}/\text{m}^3$  measured on August 14, 2005, respectively. The first and second highest PM<sub>2.5</sub> concentrations measured was 171.8  $\mu\text{g}/\text{m}^3$  on August 20, 2005 and 127.0  $\mu\text{g}/\text{m}^3$  measured on August 14, 2005, respectively. The high concentrations measured on August 14 and August 20, 2005 were part of a period of relatively high concentrations measured during a four-week period from the end of July and lasted through the end of August. In addition, a period from June 15 through June 24, 2005 was characterized by enhanced PM<sub>10</sub> and PM<sub>2.5</sub> concentrations.

Figure 1. 24-hour Average PM<sub>10</sub> Concentrations

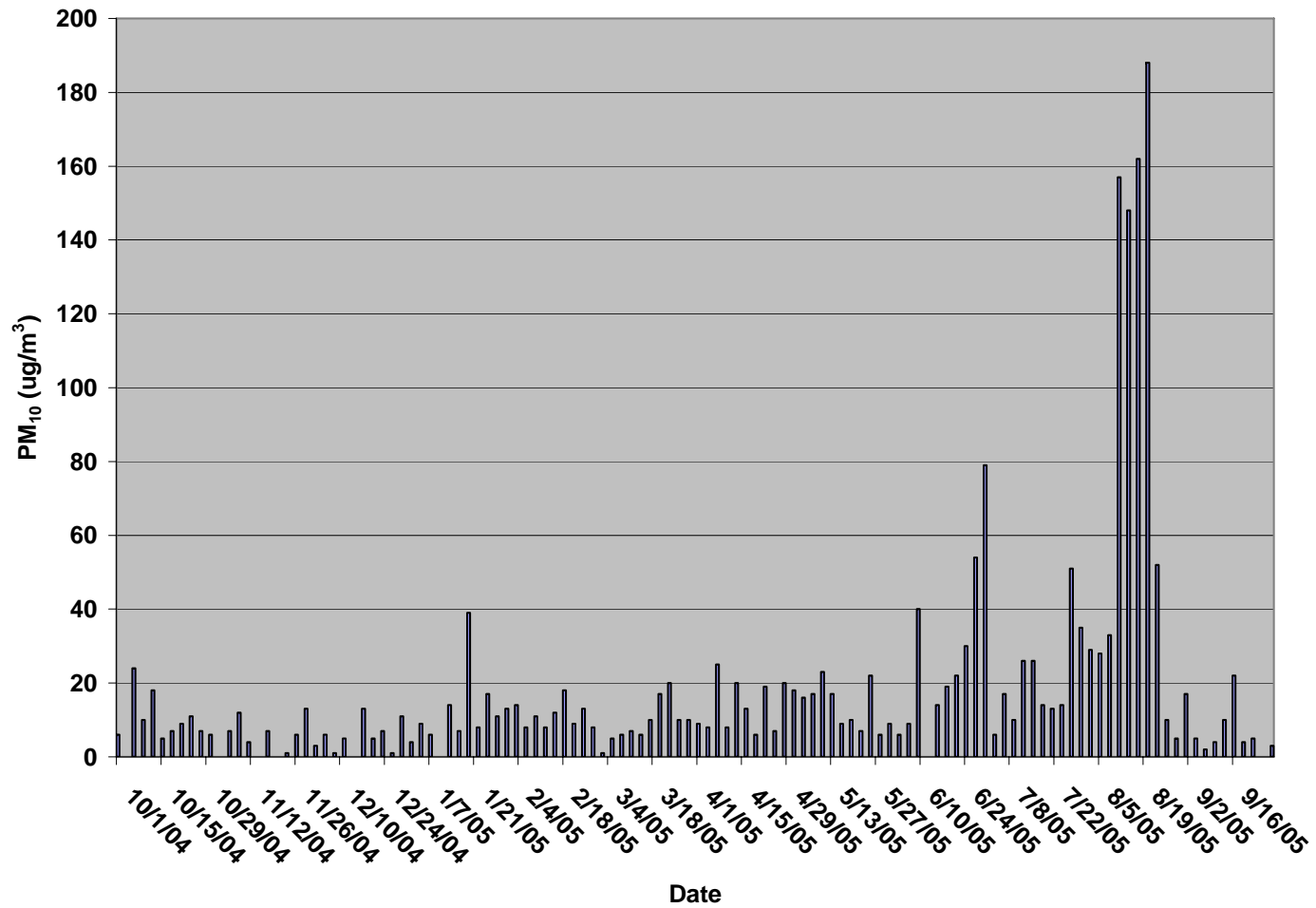
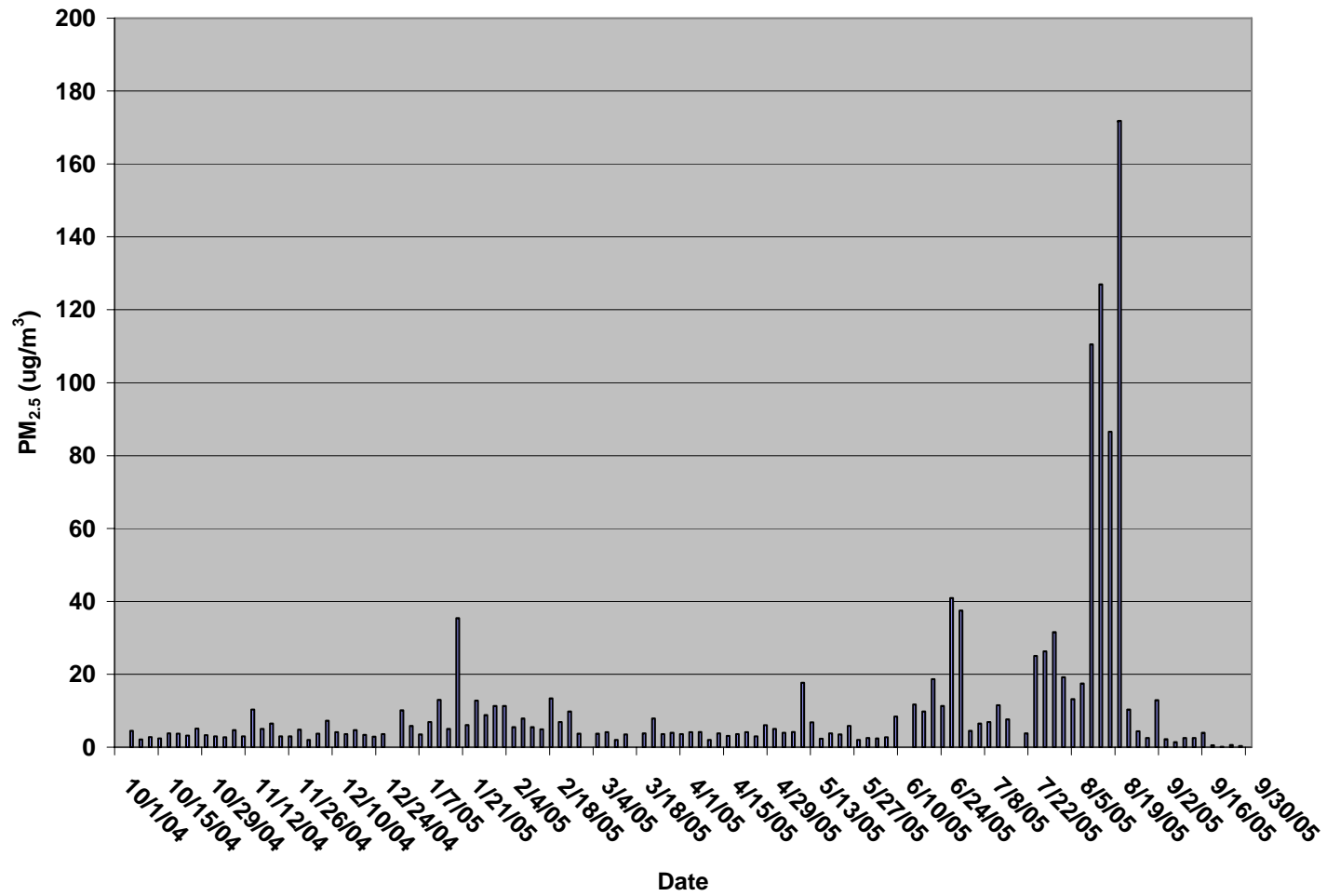


Figure 2. 24-hour Average PM<sub>2.5</sub> Concentrations



The PM<sub>10</sub> and PM<sub>2.5</sub> measurements at Eielson are valid but not all samples are representative of typical ambient particulate concentrations. Specifically, ambient particulate matter concentrations were enhanced during days in June, July, and August 2005 when smoke from a number of large lightning-caused wildfires located in Interior Alaska impacted the Eielson sampling location. During the summer of 2005, several state and federal organizations documented the severity of the fires and the impact smoke from these fires had on the air quality of Interior Alaska.

The Alaska Department of Environmental Conservation (ADEC) issued one of several air quality alerts and advisories between June 20 and August 31, 2005 ([http://www.dec.state.ak.us/air/am/2005\\_wf\\_sum.htm](http://www.dec.state.ak.us/air/am/2005_wf_sum.htm)). ADEC also measured PM<sub>2.5</sub> samples in downtown Fairbanks during this time span and observed enhanced PM<sub>2.5</sub> concentrations from mid-June to July and from late-July through August, which correspond with the periods when particulate matter concentrations were enhanced at Eielson AFB (as shown in Figure 1 and Figure 2).

The National Interagency Fire Coordination Center (NIFC) reported that, most, if not all of the fires impacting the area were caused by large wildfires in the Tanana and Upper Yukon zones of Alaska. NIFC further reported that by the end of June a total of 596,000 acres had burned in Alaska, a significant number of that acreage was in the interior of Alaska. By late-July 2005 through August 2005 many new fires had flared up and the transport of the smoke from these fires, coupled with weather conditions, resulted in poor air quality in Interior Alaska for weeks (<http://www.nifc.gov>, 2005 Alaska Wildland Fire Statistics; National Climatic Data Center, <http://www.ncdc.noaa.gov>, Climate of 2005 Wildfire Season Summary).

If there is adequate evidence that an exceptional event has caused an exceedance or violation of National Ambient Air Quality Standards (NAAQS), the U.S. Environmental Protection Agency (EPA) allows for the exclusion of air quality monitoring data from regulatory determinations related to exceedances or violations of the NAAQS and avoid designating an area as non-attainment (40 CFR 50 and 51). Therefore, the PM<sub>10</sub> and PM<sub>2.5</sub> samples measured at Eielson from June 15 through June 27, 2005 and July 27 through August 20, 2005 have been flagged as impacted by “exceptional events” as the relatively high concentrations measured during these periods corresponds with the observations of high levels of

smoke at the surface during these periods. The remainder of this analysis presents the Eielson PM<sub>10</sub> and PM<sub>2.5</sub> measurement statistics with and without excluding exceptional events to illustrate the impact the Alaska 2005 fire season had on air quality at Eielson.

The PSD data quality objective is to achieve at least 80 percent valid data recovery for four consecutive quarters for a complete one-year database. Annual and quarterly data completeness is provided in Table 1 for the PM<sub>10</sub> and PM<sub>2.5</sub> data before and after flagging the data for smoke impacts. The annual data capture in both cases meets the 80 percent requirement. However, if the flagged data is removed, the PM<sub>10</sub> and PM<sub>2.5</sub> data capture is 62.1 percent and 63.3 percent, respectively, during Quarter D (July - September, 2005) and therefore does not meet the PSD data quality standard.

**Table 1. Quarterly and Annual Particulate Matter Data Completeness**

Period	Including Extraordinary Events		Excluding Extraordinary Events	
	PM <sub>10</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Quarter A	83.9%	93.3%	83.9%	93.3%
Quarter B	100%	93.3%	100%	93.3%
Quarter C	96.8%	96.8%	83.9%	83.9%
Quarter D	100%	100%	62.1%	63.3%
Monitoring Year <sup>1</sup>	95.0%	95.9%	82.6%	83.5%

<sup>1</sup> October 1, 2004 through September 30, 2005

Table 2 and Table 3 provide summaries of the PM<sub>10</sub> statistics for the monitoring year with and without the removal of the data flagged for “exceptional events”, respectively. For comparison, both tables include a the National Ambient Air Quality Standard (NAAQS) for PM<sub>10</sub> of 150 µg/m<sup>3</sup>, which is a 24-hour standard not to be exceeded more than once per year on average over three years.

**Table 2. Eielson PM<sub>10</sub> Statistics Including “Exceptional Events”**

Period	Average (µg/m <sup>3</sup> )	1 <sup>st</sup> High Value (µg/m <sup>3</sup> )	2 <sup>nd</sup> High Value (µg/m <sup>3</sup> )	AAQs <sup>1</sup>
1 <sup>st</sup> Monitoring Quarter	7.9	24	18	150 µg/m <sup>3</sup>
Percent of AAQs	5.3%	16.0%	12.0%	
2 <sup>nd</sup> Monitoring Quarter	10.8	39	20	
Percent of AAQs	7.3%	26%	13.3%	
3 <sup>rd</sup> Monitoring Quarter	18.7	79	54	
Percent of AAQs	12.6%	52.6%	36%	
4 <sup>th</sup> Monitoring Quarter	37.8	188	162	
Percent of AAQs	25.2%	125%	108%	
Annual	19	188	162	
Percent of AAQs	38.0%	125%	108%	

<sup>1</sup> Not to be exceeded more than once per year on average for three years.

**Table 3. Eielson PM<sub>10</sub> Statistics Excluding “Exceptional Events”**

Period	Average (µg/m <sup>3</sup> )	1 <sup>st</sup> High Value (µg/m <sup>3</sup> )	2 <sup>nd</sup> High Value (µg/m <sup>3</sup> )	AAQs <sup>1</sup>
1 <sup>st</sup> Monitoring Quarter	7.9	24	18	150 µg/m <sup>3</sup>
Percent of AAQs	5.3%	16.0%	12.0%	
2 <sup>nd</sup> Monitoring Quarter	10.8	39	20	
Percent of AAQs	7.3%	26.0%	13.3%	
3 <sup>rd</sup> Monitoring Quarter	14.5	40	25	
Percent of AAQs	12.6%	26.7%	16.7%	
4 <sup>th</sup> Monitoring Quarter	11.1	26	26	
Percent of AAQs	7.4%	17.3%	17.3%	
Annual	11.0	40	39	
Percent of AAQs	7.3%	26.7%	26.0%	

<sup>1</sup> Not to be exceeded more than once per year on average for three years.

If the exceptional events of 2005 are included in the data set, then the NAAQS PM<sub>10</sub> 24-hour limit of 150 µg/m<sup>3</sup> is exceeded on three days: August 11, 2005 (157 µg/m<sup>3</sup>), August 17, 2005 (162 µg/m<sup>3</sup>), and August

20, 2005 (188  $\mu\text{g}/\text{m}^3$ ). If the flagged data is excluded from the statistical analysis, then the first and second highest  $\text{PM}_{10}$  concentrations are 40 and 39  $\mu\text{g}/\text{m}^3$  measured on June 9, 2005 and January 19, 2005, respectively, both of which are well below the NAAQS  $\text{PM}_{10}$  limit.

Table 4 and Table 5 provide summaries of the  $\text{PM}_{2.5}$  statistics for the monitoring year with and without the removal of the flagged data. Both tables show the quarterly and annual average  $\text{PM}_{2.5}$  concentrations and first and second highest concentrations measured during the respective monitoring period. The  $\text{PM}_{2.5}$  NAAQS limits are an annual (15  $\mu\text{g}/\text{m}^3$ ) and a 24-hour (35  $\mu\text{g}/\text{m}^3$ ) limit and are included in Table 4 and Table 5 for comparison. Specifically, the annual  $\text{PM}_{2.5}$  standard requires that the 3-year average of the weighted annual mean  $\text{PM}_{2.5}$  concentration not exceed 15.0  $\mu\text{g}/\text{m}^3$ . The 24-hour standard is a concentration-based percentile form, indicating the percentage of the time that a monitoring station can exceed the standard. For example, a 98<sup>th</sup> percentile 24-hour standard indicates that a monitoring station can exceed the standard 2% of the days during the year. This standard did not become effective until December 17, 2006, after the Eielson monitoring program had ended.

**Table 4. Ambient Air Monitoring –  $\text{PM}_{2.5}$**

Period	Average ( $\mu\text{g}/\text{m}^3$ )	1 <sup>st</sup> High Value ( $\mu\text{g}/\text{m}^3$ )	2 <sup>nd</sup> High Value ( $\mu\text{g}/\text{m}^3$ )	AAAQS
1 <sup>st</sup> Monitoring Quarter	4.0	10.3	7.3	35 $\mu\text{g}/\text{m}^3$
Percent of AAAQS	11.4%	29.4%	20.9%	
2 <sup>nd</sup> Monitoring Quarter	7.9	35.4	13.4	
Percent of AAAQS	22.6%	101.1%	38.3%	
3 <sup>rd</sup> Monitoring Quarter	8.0	40.9	37.5	
Percent of AAAQS	22.9%	116.9%	107.1%	
4 <sup>th</sup> Monitoring Quarter	23.8	171.8	127.0	
Percent of AAAQS	68.0%	490.9%	362.9%	
Annual	11.1	171.8	127.0	15 $\mu\text{g}/\text{m}^3$
Percent of AAAQS	74.0%	NA <sup>1</sup>	NA	

<sup>1</sup> Not applicable to NAAQS  $\text{PM}_{2.5}$  annual average limit.

**Table 5. Ambient Air Monitoring Excluding Smoke Events – PM<sub>2.5</sub>**

Period	Average (µg/m <sup>3</sup> )	1 <sup>st</sup> High Value (µg/m <sup>3</sup> )	2 <sup>nd</sup> High Value (µg/m <sup>3</sup> )	AAAQS
1 <sup>st</sup> Monitoring Quarter	4.0	10.3	7.3	35 µg/m <sup>3</sup>
Percent of AAAQS	11.4%	29.4%	20.9%	
2 <sup>nd</sup> Monitoring Quarter	7.9	35.4	13.4	
Percent of AAAQS	22.6%	101.1%	38.3%	
3 <sup>rd</sup> Monitoring Quarter	5.0	17.7	11.7	
Percent of AAAQS	14.3%	50.6%	33.4%	
4 <sup>th</sup> Monitoring Quarter	3.9	12.9	11.5	
Percent of AAAQS	11.1%	36.9%	32.9%	15 µg/m <sup>3</sup>
Annual	5.3	35.4	17.7	
Percent of AAAQS	35.3%	NA <sup>1</sup>	NA	

<sup>1</sup> Not applicable to NAAQS PM<sub>2.5</sub> annual average limit.

The annual average PM<sub>2.5</sub> concentrations are 11.1 µg/m<sup>3</sup> and 5.3 µg/m<sup>3</sup> for including and excluding the “exceptional event” flagged data, respectively. In both cases, Eielson AFB is in compliance with the NAAQS PM<sub>2.5</sub> annual average limit. Including the “exceptional events” data in the Eielson AFB PM<sub>2.5</sub> dataset, the NAAQS PM<sub>2.5</sub> 24-hour standard of 35 µg/m<sup>3</sup> is exceeded five days during the monitoring year. If the “exceptional events” data is removed from PM<sub>2.5</sub> dataset, then the NAAQS PM<sub>2.5</sub> 24-hour standard of 35 µg/m<sup>3</sup> is exceeded for only one day of the monitoring year, January 19, 2005, when the measured PM<sub>2.5</sub> concentration was 35.4 µg/m<sup>3</sup>. Therefore, the NAAQS PM<sub>2.5</sub> 24-hour limit would be exceeded without accounting for “exceptional events”, but are compliant with PM<sub>2.5</sub> NAAQS if the flagged data are excluded from the analysis.