

Air Quality Monitoring  
in  
Fort Yukon, Alaska

June 2018-August 2018

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Air Quality Division

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&  
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Program

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## **EXECUTIVE SUMMARY**

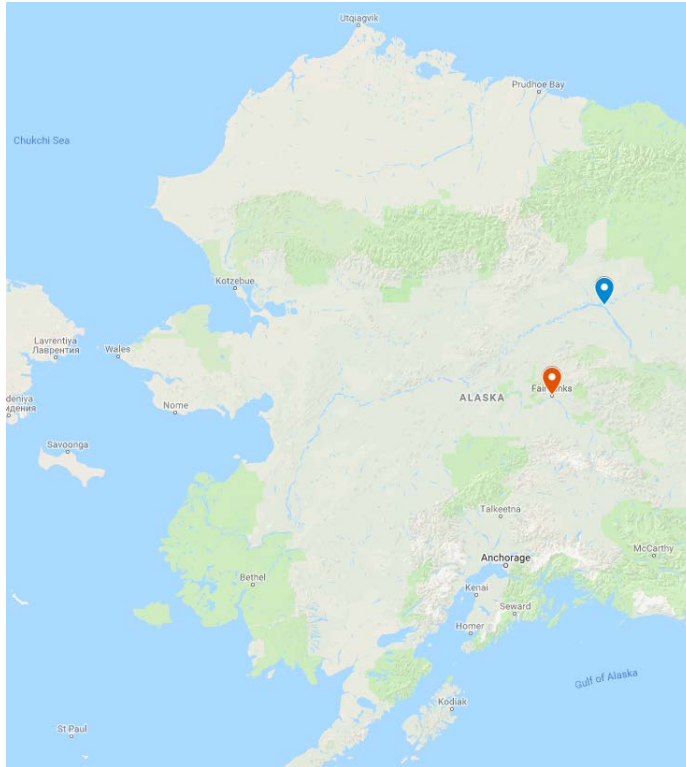
In the summer of 2018, air monitoring was conducted in Ft. Yukon, Alaska for particulate matter (PM) under 10 microns in diameter (PM<sub>10</sub>, often associated with windblown or road dust) and PM under 2.5 microns in diameter (PM<sub>2.5</sub>, usually associated with smoke or exhaust of combustion processes). The State of Alaska Department of Environmental Conservation (DEC) began monitoring on June 7, 2018 and concluded August 16, 2018. PM<sub>2.5</sub> monitoring was primarily conducted for assessing the air quality impact of wildland fire smoke and the PM<sub>10</sub> monitoring was conducted to better assess the health impact of dust in the community. The data collected during the 2018 summer season shows PM<sub>2.5</sub> concentrations below EPA standards. On the other hand the PM<sub>10</sub> analyzer occasionally recorded PM<sub>10</sub> concentrations near or above the standard, and was likely dust from the adjacent gravel roadway.

## **INTRODUCTION**

The Alaska State Legislature has mandated the Department of Environmental Conservation (DEC) to assess, evaluate, and mediate environmental issues that may affect the health and welfare of residents within the state (Title 46 of the Alaska Statutes). DEC established and maintains a statewide network of regulatory and special purpose monitoring sites that collect ambient air data, usually in the state's population centers. DEC uses this data to assess the air quality within the state.

In 1997 the U.S Environmental Protection Agency (EPA) required that all states establish airborne fine particulate (PM<sub>2.5</sub>) monitoring networks. DEC incorporated this requirement into its existing, statewide network of regulatory and special purpose monitoring sites. DEC maintains regulatory PM<sub>2.5</sub> monitoring sites in Juneau, Anchorage, the Matanuska-Susitna Borough, and Fairbanks. Seasonal or Special purpose monitoring sites are established for short term or seasonal investigation or specific studies statewide. DEC first set up a special-purpose monitoring site at Fort Yukon in the summer of 2010 after the occurrence of especially extensive wildland fires in interior Alaska in the summer of 2009 affected air quality in Fort Yukon and the surrounding area. State sponsored air monitoring has continued in the community during most of the following summer seasons. DEC uses the Ft Yukon PM<sub>2.5</sub> data to assess smoke impacts in the interior of Alaska and as a basis for issuing air quality advisories. In 2018, DEC began monitoring for PM<sub>10</sub> at the site in response to requests from local residents due to the prevalence of road dust in the community.

## Background



**Figure 1.**

Map of Alaska. Fort Yukon marked with blue dot and Fairbanks marked with orange dot.

Source: Google Maps

Fort Yukon is located at the confluence of the Yukon and Porcupine Rivers, about 145 air miles northeast of Fairbanks, as shown in Figure 1. The community lies at approximately 66.564720° North Latitude and -145.273890° West Longitude. (Sec. 18, T020N, R012E, Fairbanks Meridian). Fort Yukon is located in the Fairbanks Recording District. The area encompasses 7.0 sq. miles of land and 0.4 sq. miles of water. The winters in the Ft Yukon area are long and harsh, and the summers are short but warm. Daily minimum temperatures between November and March are usually below 0 °F. Extended periods of -50 to -60 °F are common. Summer high temperatures run 65 to 72 °F; a high of 97 °F has been recorded. Total annual precipitation averages 6.58 inches, with 43.4 inches of snowfall. The Yukon River typically is ice-free from the end of May through mid-September. According to the US Census 2010, there were 325 housing units in the community of which 246 were occupied and there were 583 residents.

## Public Health and Air Quality Standards

Following the passing of the Clean Air Act and the subsequent amendments by Congress, the Environmental Protection Agency was tasked with establishing National Ambient Air Quality Standards (NAAQS) for criteria pollutants to protect the health of the public, including “sensitive” populations, such as the elderly and children. These types of standards are called primary standards. Additionally, the EPA establishes secondary standards for criteria pollutants which are intended to prevent property damage, such as crop damage, and reduction in visibility. Annual mean standards are intended to prevent health risks from chronic exposure and shorter term standards like the 24 hour PM standards are intended to prevent health risks from acute exposure to air pollutants.

The main air pollutant of concern in wildland fire smoke is particulate matter. Particulate matter is frequently classified by size and is described by using an aerodynamic diameter<sup>1</sup> measured in micrometers or millionths of a meter ( $\mu\text{m}$ ). Human hair has a diameter of about 50 to 70  $\mu\text{m}$ . Health reviews have shown that particles greater than 10  $\mu\text{m}$  primarily lodge in the oral and nasal passages. These particles are largely eliminated by natural body processes and do not penetrate farther into the respiratory tract. On the other hand, particles smaller than 10  $\mu\text{m}$ , referred to as  $\text{PM}_{10}$ , can travel deep into the respiratory tract and may lodge in the lungs. Respirable particulates, some of the smallest particles under 2.5  $\mu\text{m}$  in diameter, can be deposited in the alveoli (the lungs' very small air sacs). The particulates inhibit lung function by making the transfer of oxygen and carbon dioxide slower causing the heart to work harder to achieve the same rate of transfer. This is most noticeable in children and the elderly as well as people with respiratory diseases like bronchitis, asthma, emphysema, or heart problems. However, all people may be affected by particulate matter inhalation with adverse effects that may only appear with repeated exposure.  $\text{PM}_{2.5}$  particulates may contain carcinogens and other poisonous substances harmful to the body. Numerous scientific studies have linked exposure to particulate matter pollution with a variety of possible health effects, including: decreased lung function, asthma, irregular heartbeat, heart attacks, and premature death.

The EPA has set the primary and secondary annual mean standards (NAAQS) for  $\text{PM}_{2.5}$  as 12.0  $\mu\text{g}/\text{m}^3$  and 15.0  $\mu\text{g}/\text{m}^3$ , respectively. The 24 hour standard for  $\text{PM}_{2.5}$  is currently 35  $\mu\text{g}/\text{m}^3$ . For  $\text{PM}_{10}$ , the EPA has set the primary and secondary 24 hour standards at 150  $\mu\text{g}/\text{m}^3$ .

## Monitoring

On May 31, 2018 DEC staff installed two Met One Beta Attenuation Monitor (BAM) 1020s in a mobile sampling trailer located at the intersection of Spruce Street and East 7<sup>th</sup> Avenue in Fort Yukon. BAMs measure particulate matter concentrations on an hourly basis using a Carbon-14 source is used to generate beta rays. The instrument measures the beta ray count on the clean tape prior to sampling and the count of the tape after the sampling period. This difference in counts is used to determine the concentration of particulate matter on the filter tape. The monitors started reporting data on June 7<sup>th</sup>, after completing their zero air test calibration. Both PM samplers used a  $\text{PM}_{10}$  size selective inlet. The  $\text{PM}_{2.5}$  BAM 1020 operated with a Sharp Cut Cyclone to eliminate any particles larger than 2.5 microns. Site visits occurred on June 19<sup>th</sup>, July 10<sup>th</sup>, and August 16<sup>th</sup>. At each visit, quality control (QC) checks were performed on the instruments to ensure that they were operating correctly, and routine maintenance was conducted. The BAMs were removed from the site upon completion of the QC checks on August 16<sup>th</sup>.

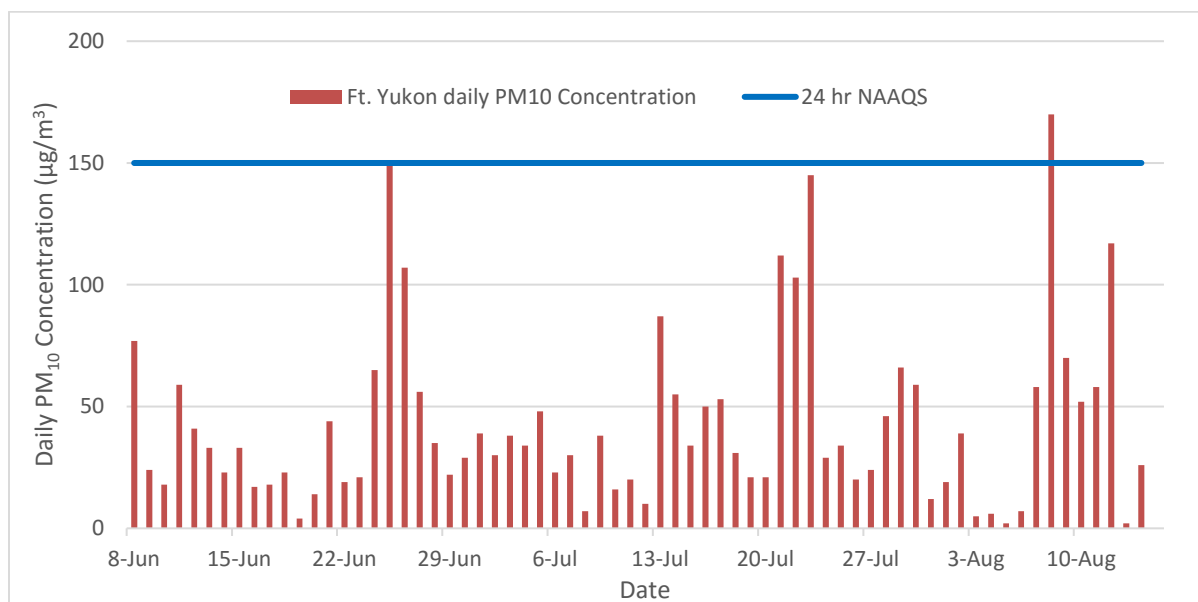
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<sup>1</sup> Aerodynamic diameter refers to a spherical particle with the density equal to the actual particle. It has the same gravitational settling velocity as the actual particle.

## RESULTS

### PM<sub>10</sub> Summary

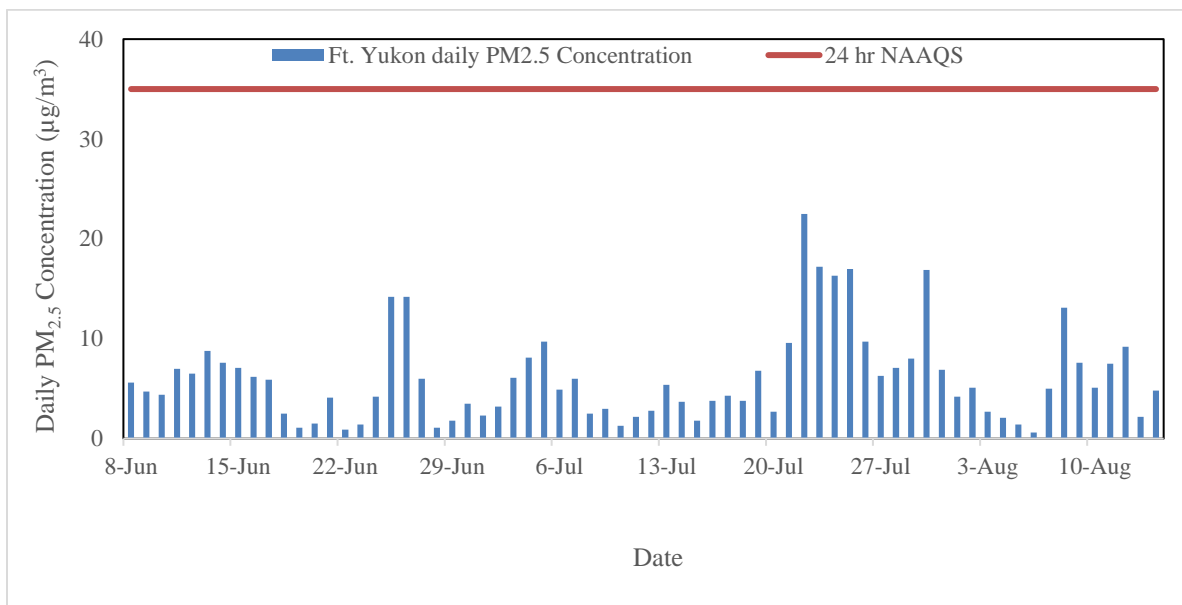
A summary of the daily PM<sub>10</sub> concentration is shown below in Figure 2. One exceedance of the NAAQS for 24 hour PM<sub>10</sub> was recorded on August 8<sup>th</sup>, with a concentration of 170 µg/m<sup>3</sup>. The average PM<sub>10</sub> concentrations on June 25<sup>th</sup> and July 23<sup>rd</sup> were 150 µg/m<sup>3</sup> and 145 µg/m<sup>3</sup> respectively, which are close to the exceeding the 24 hour PM<sub>10</sub> NAAQS of 150 µg/m<sup>3</sup>. The expected source of the PM<sub>10</sub> is road dust, as the roads in Ft. Yukon are not paved and the site is directly adjacent to a street. The meteorological data did not indicate high wind speeds, which could indicate windblown dust from the river beds.



**Figure 2**  
24hr average PM<sub>10</sub> Concentration in Ft. Yukon, Alaska Summer 2018

### PM<sub>2.5</sub> Summary

During the 2018 summer the 24 hour average PM<sub>2.5</sub> concentration did not exceed 22.5 µg/m<sup>3</sup>, as shown below in Figure 3. As PM<sub>2.5</sub> is a large component of wildland fire smoke, the air quality in the community was not significantly impacted by wildland fire smoke in 2018 and no exceedances of the NAAQS were recorded. While wildland fire smoke surrounded Ft. Yukon all season long, visible smoke was only present over the town for a few days. Overall, the summer of 2018 was a mild season for wildland fires in Alaska. The Alaska Interagency Coordination Center estimates the total area burned in 2018 at less than 412,000 acres; this amount of acreage is approximately 32% of the average acres burned for the previous decade and 71% of the median acreage burned in the previous decade.



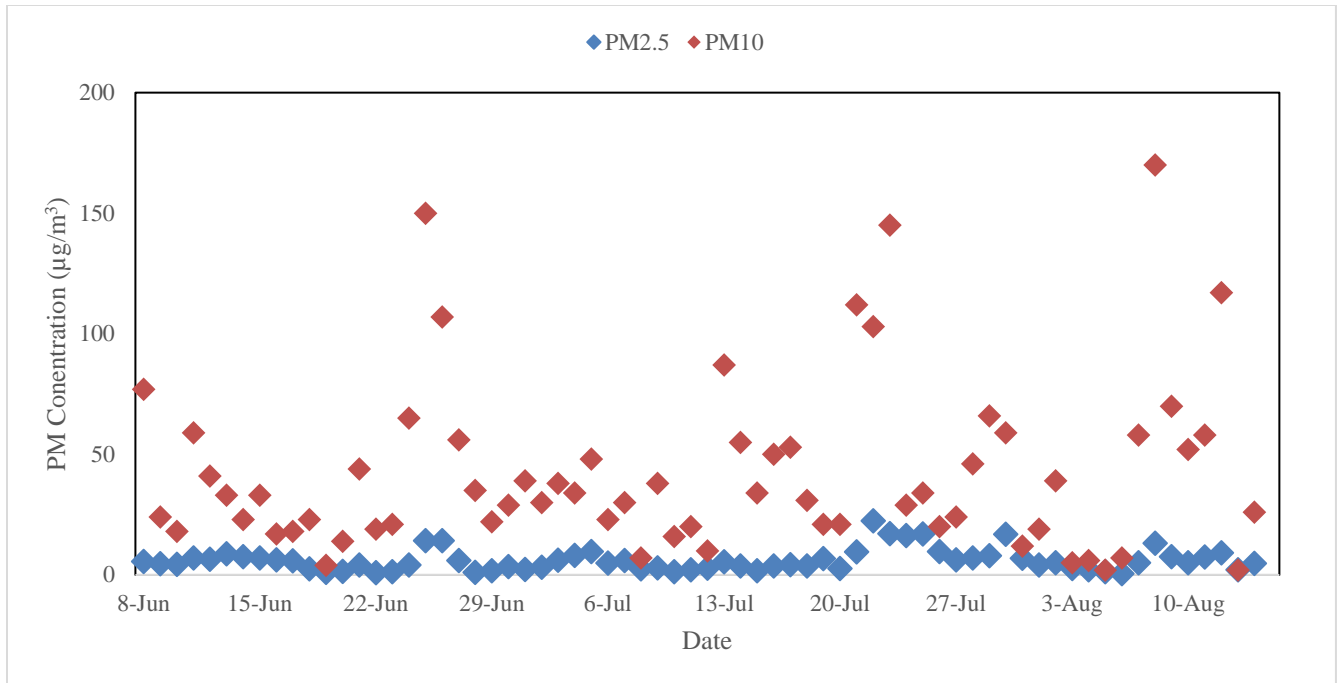
**Figure 3**  
24hr average PM<sub>2.5</sub> Concentration in Ft. Yukon, Alaska Summer 2018

## Data Quality

DEC’s routine checks demonstrated that the instruments were operating as designed during the study period, meeting the EPA’s specified accuracy criteria for flow, ambient temperature, and barometric pressure. At each site visit, maintenance consisting of: cleaning the inlets, cleaning the nozzle and vane, and cleaning the capstan and rollers was completed. While the temperature control in the shelter was observed to fluctuate more than the recommended level of 2.1°C per 24 hours on several occasions, it remained within manufacturers’ specified normal operating range. As the temperature control for the shelter is not a critical data quality criteria, per EPA requirements, the impact of this on the data quality is considered minimal.

A comparison of the daily averages from the PM<sub>2.5</sub> and PM<sub>10</sub> instruments is shown below in Figure 4. As expected, increases in the PM<sub>2.5</sub> concentrations corresponded to increases in the PM<sub>10</sub> concentrations. As PM<sub>10</sub> includes the particles that comprise PM<sub>2.5</sub>, the PM<sub>10</sub> concentration should be equal to or larger than the PM<sub>2.5</sub> concentration. For this data set, after accounting for the instrument’s error range, this was the case.





**Figure 4**  
Comparison of 24hr average PM<sub>10</sub> and PM<sub>2.5</sub> Concentrations in Ft. Yukon, AK  
Summer 2018

## CONCLUSIONS

One exceedance to the NAAQS was observed for PM<sub>10</sub>, most probably due to the prevalence of road dust in the community. For approximately eighty-seven percent of the sampling days though, the average PM<sub>10</sub> concentration was less than fifty percent of the NAAQS. As no exceedances were observed for the PM<sub>2.5</sub>, it does not appear that wildland fire smoke and other sources significantly impacted the air quality of the region in this period of 2018. The local community is highly attuned to the road dust issue and has been seeking methods and funds to address this concern.

## REFERENCES CITED

- 1) 2017 Fire Season Weather Summary, Alaska Interagency Coordination Center, <https://fire.ak.blm.gov/predsvcs/weather.php>
- 2) AICC Situation Report- November 28<sup>th</sup>, 2018, Alaska Interagency Coordination Center, <https://fire.ak.blm.gov/predsvcs/Earlier%20Years.php>
- 3) U.S. Census 2010, U.S. Census Bureau, <http://www.census.gov/2010> census