North Pole Saturation Study Update

PRELIMINARY FINDINGS – 9/22/17

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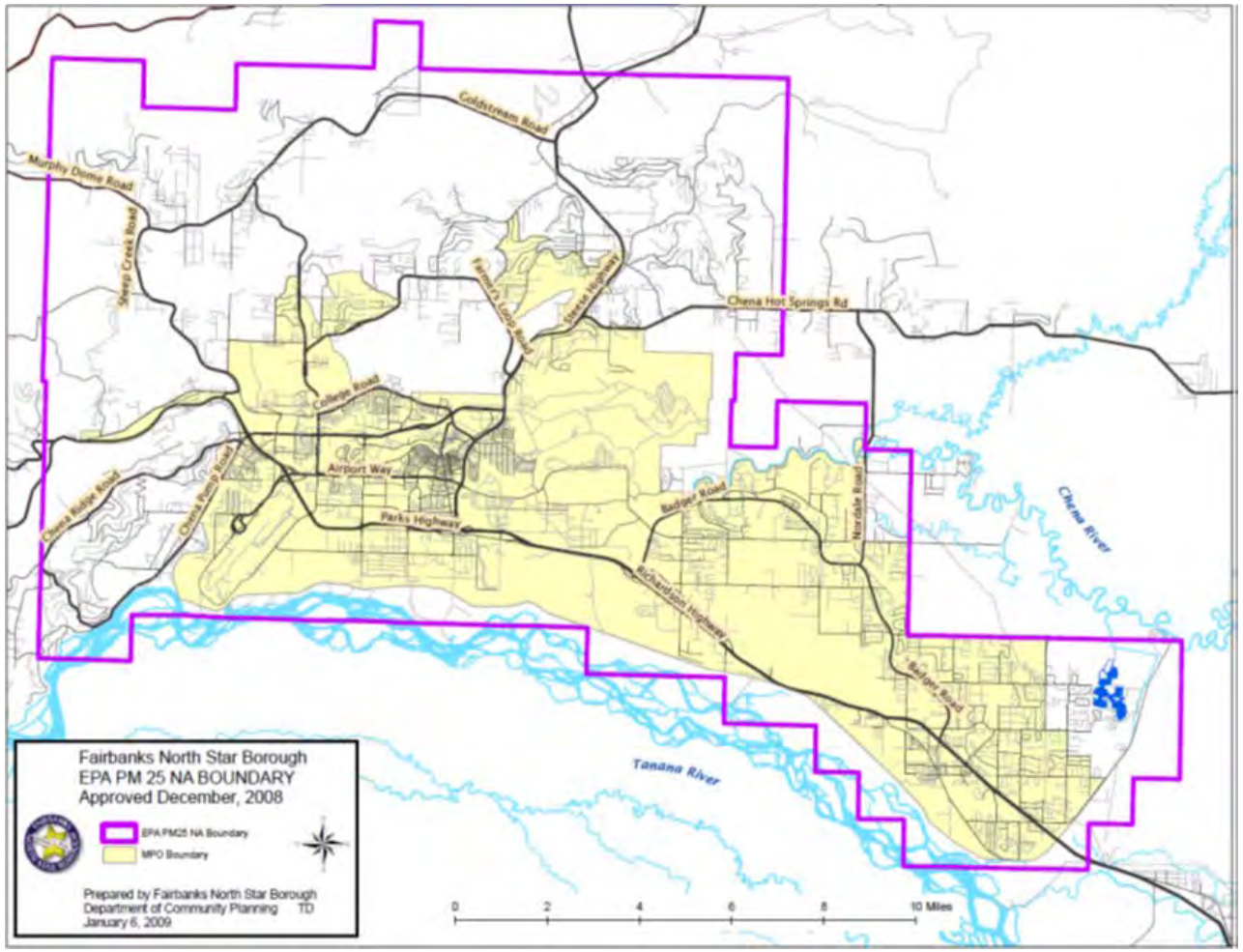
Background

- Non-attainment area designation in 2009
  - Based on 1 monitor
  - SOB downtown Fairbanks
  - Based on data from 2006-2008

- North Pole Monitoring started in 2008
  - Temporary site at NP Elementary
    - Only intended for 1 winter season
    - While looking for a more permanent spot
  - NP Fire Station 3 established in 2011
    - Initially only winter time
    - Since 2015 considered a regulatory site



Short Term Monitoring Sites 2014-2016

Sites in North Pole:

Ticasuk-Brown Elementary

Bright Electric

North Star Fire Station #2

Badger Road Elementary

Dixon Road

North Pole Water 2

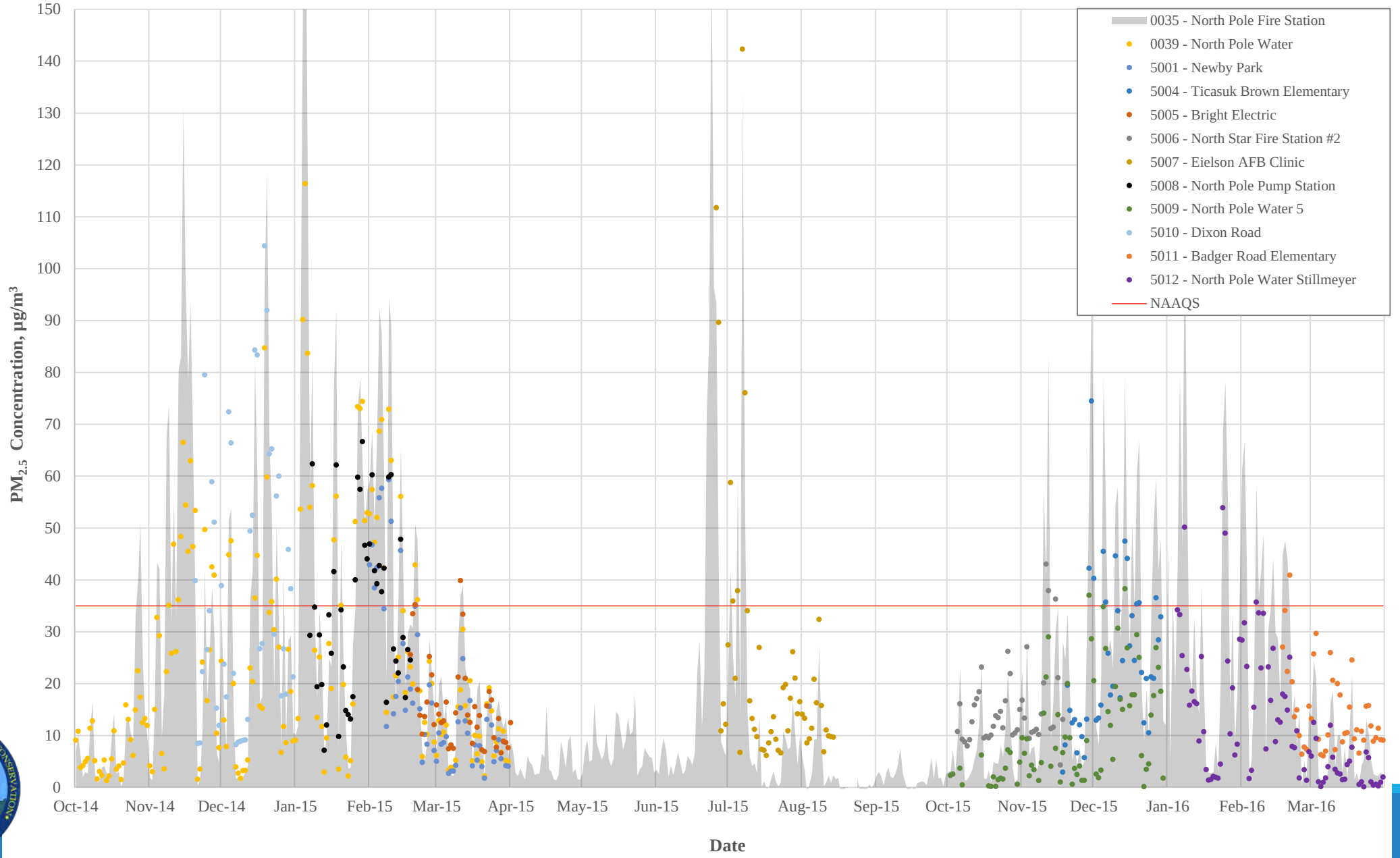
North Pole water 5

North Pole Pump Station

North Pole Water Stillmeyer

Newby Park

SPM monitoring data compared to NPFS (10/14-3/16)



Saturation Study Objectives:

- To evaluate the spatial characteristics of ambient $PM_{2.5}$ concentrations across the North Pole area during wintertime episodes:

  - To identify ambient $PM_{2.5}$ concentrations residents are being exposed to beyond the NPFS monitor; and
  - To evaluate where a new monitor could be placed, if necessary, to better represent neighborhood scale impacts

→ Is the NPFS site representative for the area ?

Organization

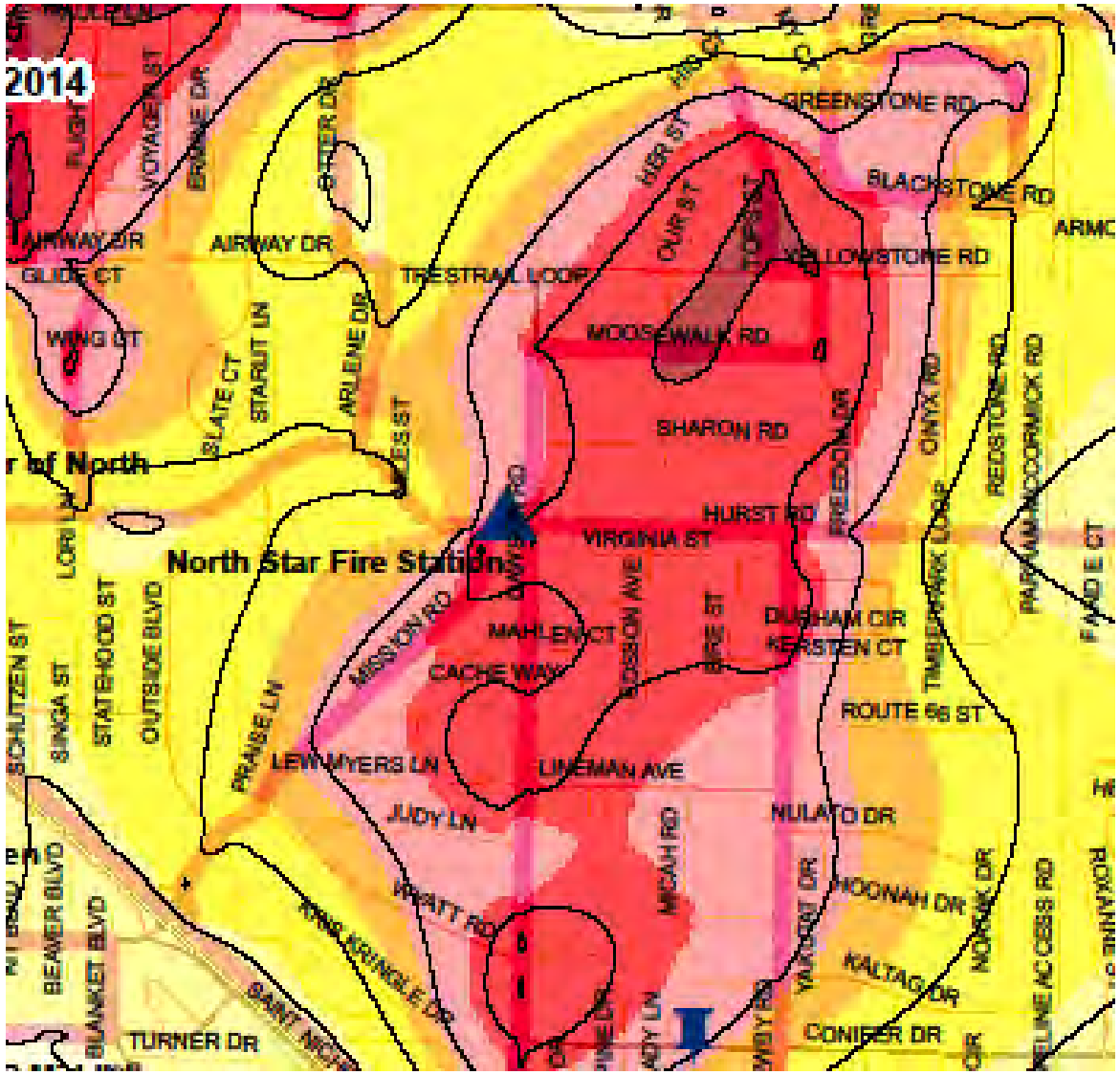
- **DEC**
  - Technical Assistance
  - Outreach
  - Obtained Funding
  - Oversight
  - Data Analysis
- **Sierra Research (DEC contractor)**
  - Project Planning and Management
  - Data Analysis
- **T&B Systems (Sub-contractor)**
  - Equipment Selection
  - Data Collection
  - Quality Assurance
- **FNSB**
  - Technical Assistance
  - Site selection
  - Community Outreach
- **EPA**
  - Technical Assistance
    - Review and approve study design
  - Review and approve findings
  - Assist with site selection if warranted

Study Design

Based on hourly BAM data collected at the NPFS monitoring station from 2013-2015, and the special purpose monitoring and mobile “sniffer” PM survey data previously collected by the FNSB

Fixed-Site Monitoring

- 11 additional fixed-site monitors were placed and operated continuously during the study period.
- Siting was set back from the main roads and away from local sources to try to capture the most representative data of a neighborhood scale within a broad area of North Pole
- Extend roughly 2 miles outward from the NPFS site (neighborhood scale)
- Timing: to catch exceedance days, i.e. days with temperatures at -15°F



NP composite sniffer map of 2014/15 winter drives

Mobile Monitoring - 'Virtual Sites'

Goal

- Evaluate small scale variations associated with localized sources and microscale phenomena

→ Create a dense network of 'virtual sites', using fixed monitors would be too costly

Technique

- Sniffer vehicle travelled a defined route once each hour for periods of four hours
  - Morning, Midday, Evening, Night
  - Measuring $PM_{2.5}$ Concentration and GPS Coordinates at 1-second intervals

Data Processing

- 'Bin' the 1- second measurements into 25-meter bins surrounding 1153 'virtual sites'
- Average those 1-second measurements to produce a 1-hour average concentration for each bin
- Average the individual bins' hourly concentrations into a 4-hour average
- Testing Validity by comparing mobile bins to nearby fixed sites

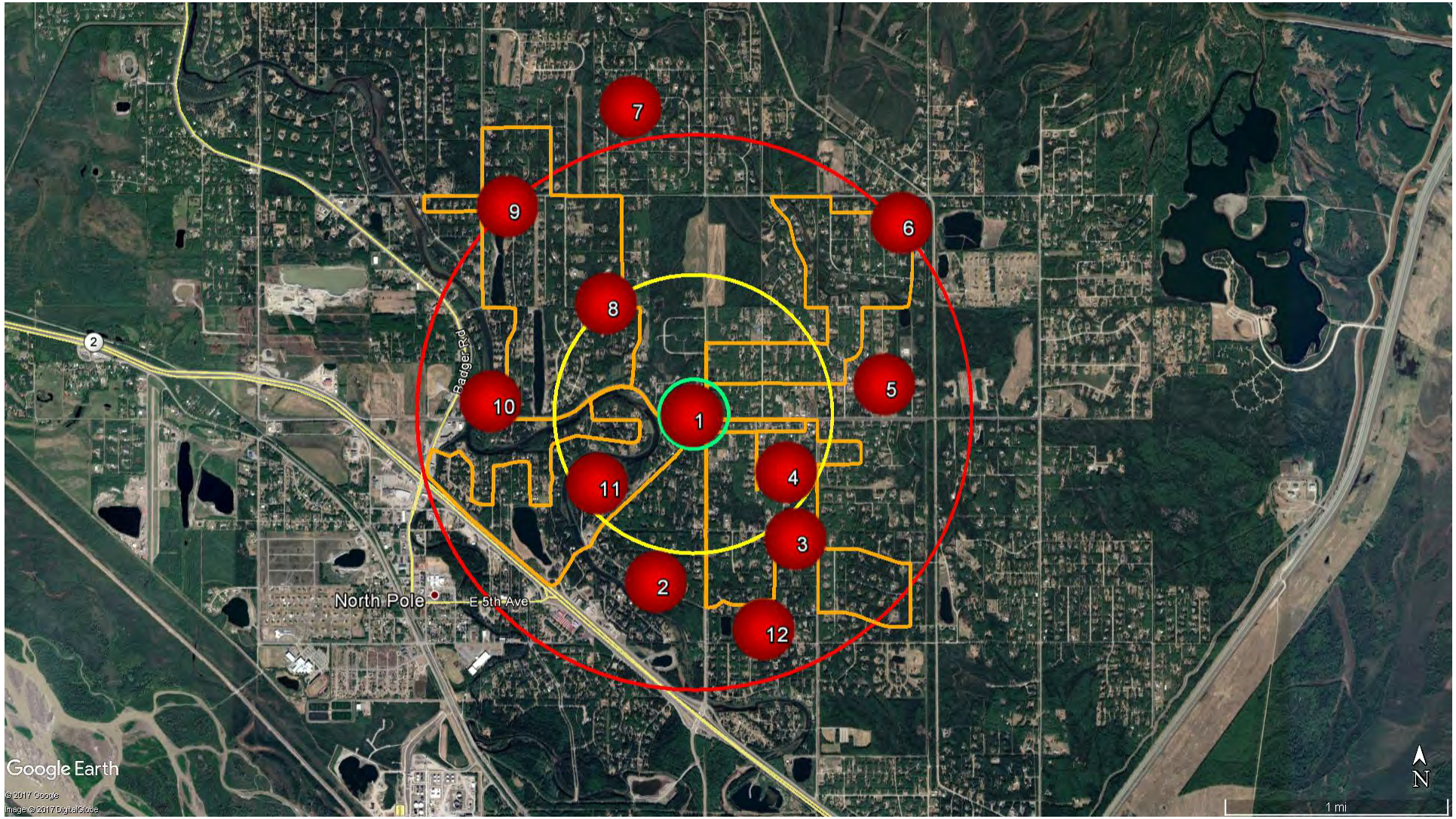
Equipment

Thermo Personal Data Ram (pDR) Model 1500 samplers was used for all $PM_{2.5}$ measurements

- Used for stationary and mobile monitoring
- Same as FNSB 'sniffer' vehicle set-up

- **pDR is a low cost monitor**
- **Not qualified for use in regulatory purposes**

Stationary Sites and Mobile Routes



Timeline

Fixed Sites:

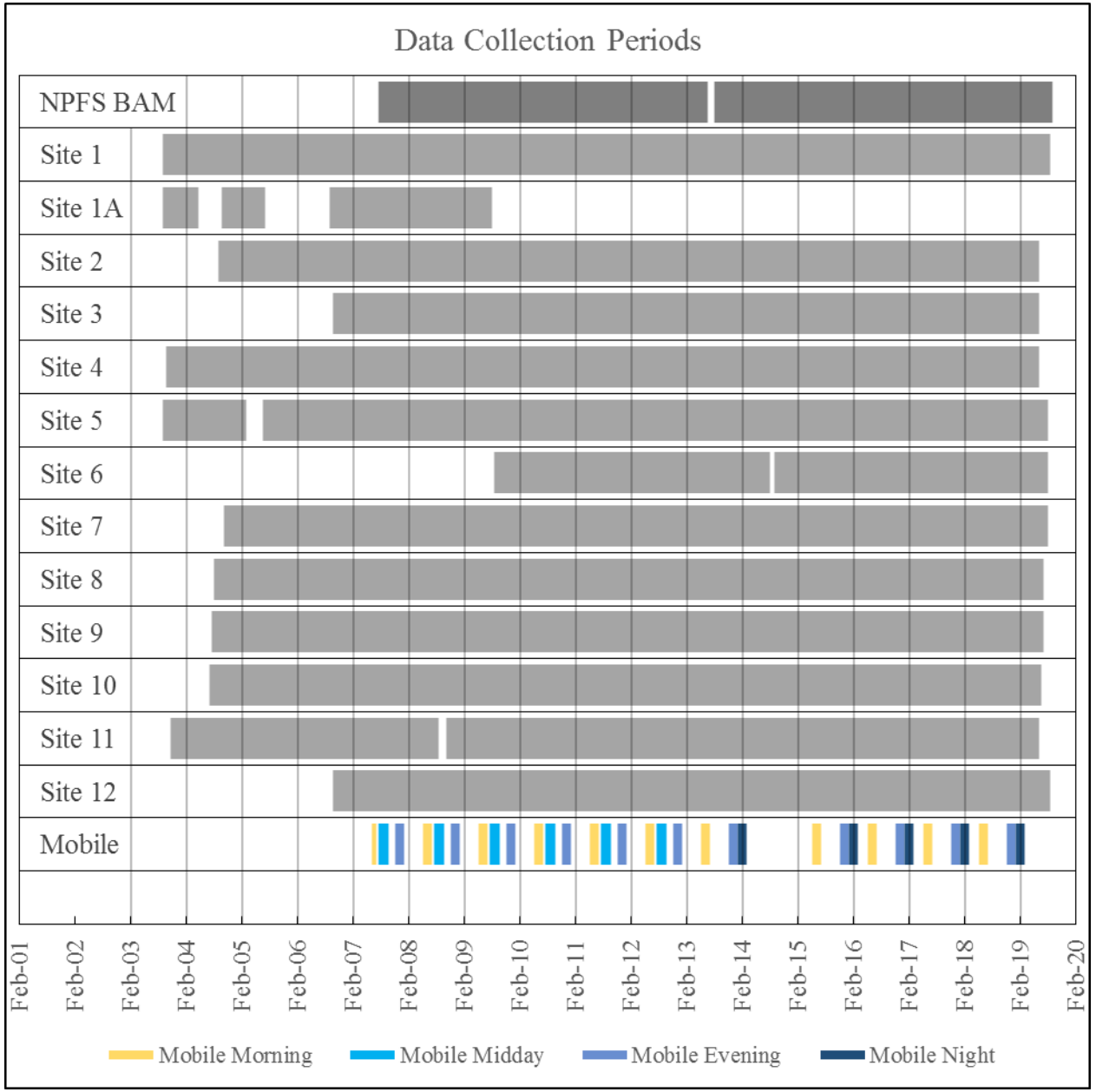
February 3rd through 19th , 2017

- 14 Days

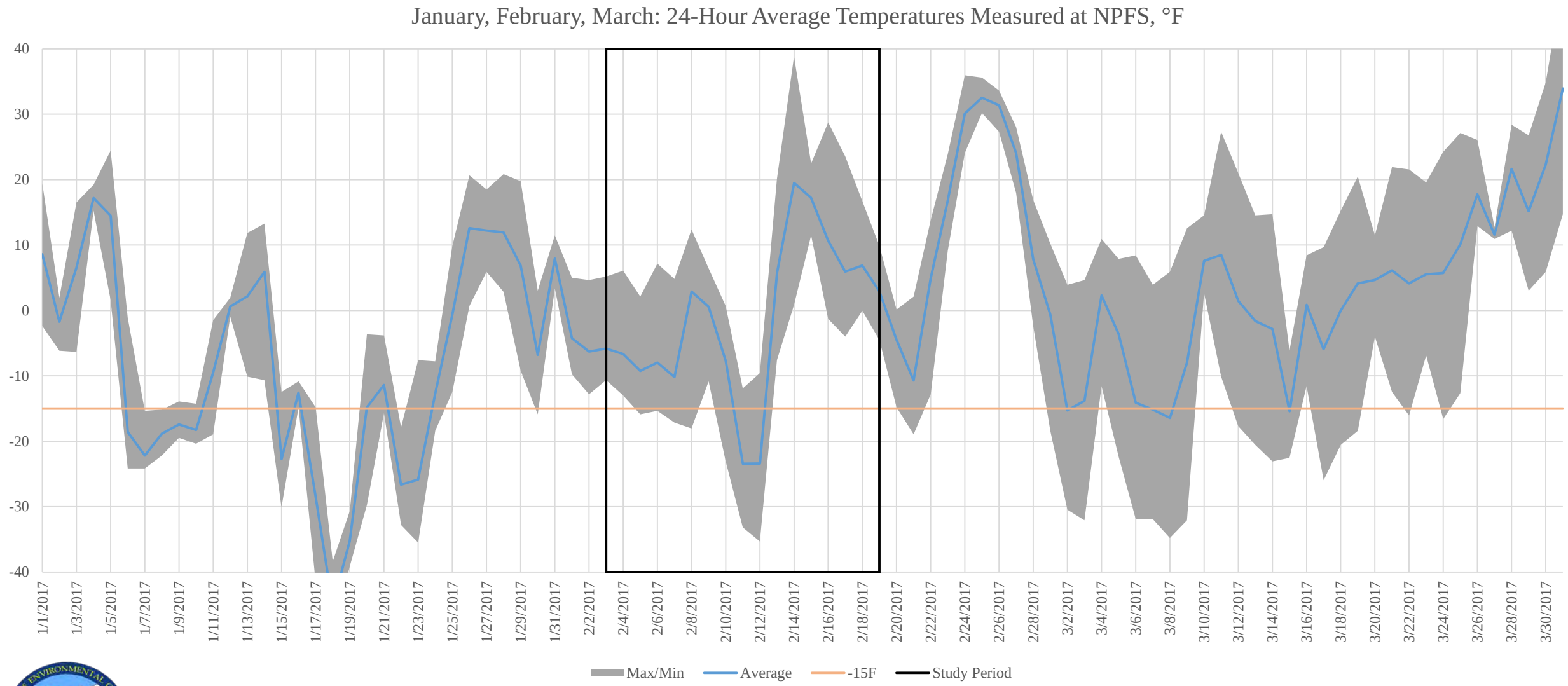
Mobile Monitoring:

February 7th through 18th , 2017

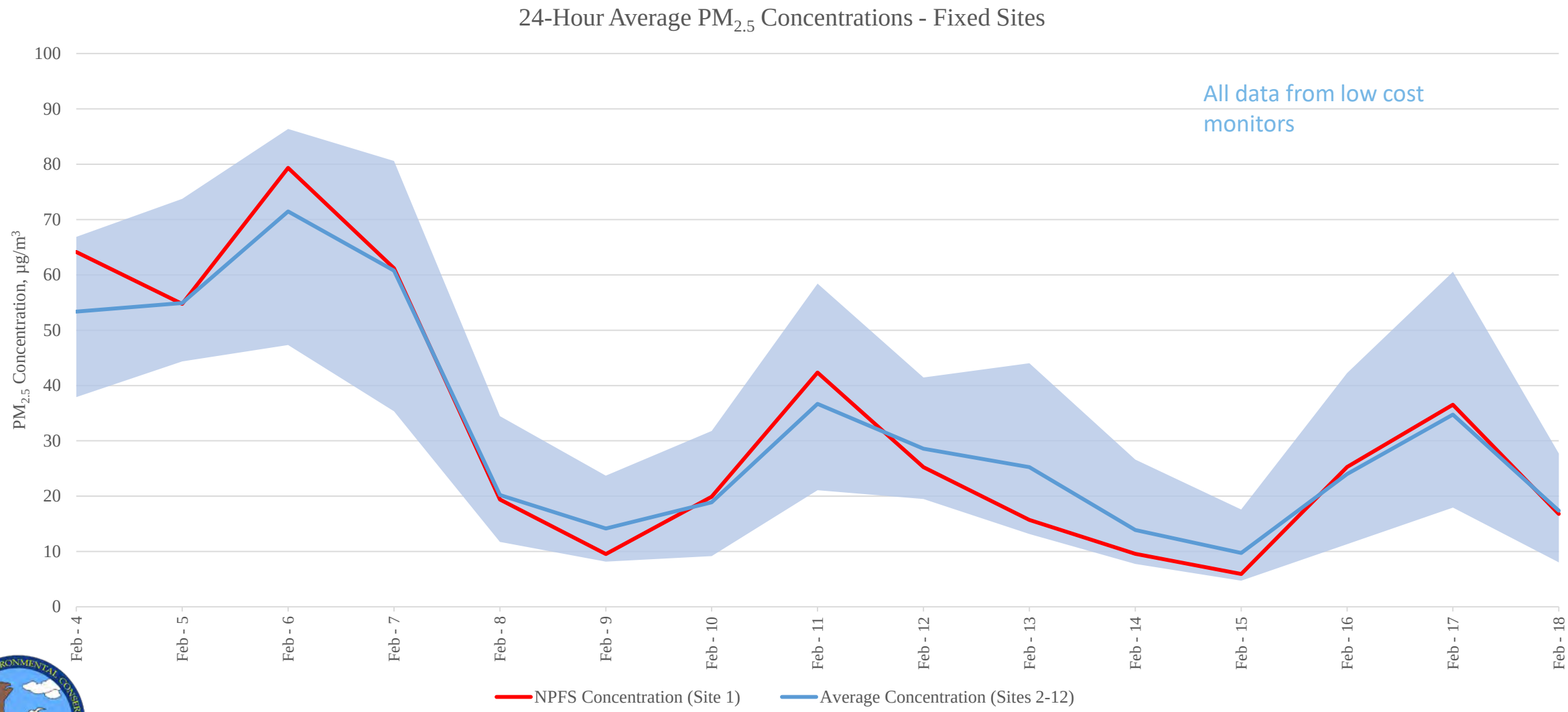
- 11 Morning Runs 6AM to 10AM
- 6 Midday Runs 11AM to 3PM
- 11 Evening Runs 6PM to 10PM
- 5 Night Runs 10PM to 2AM



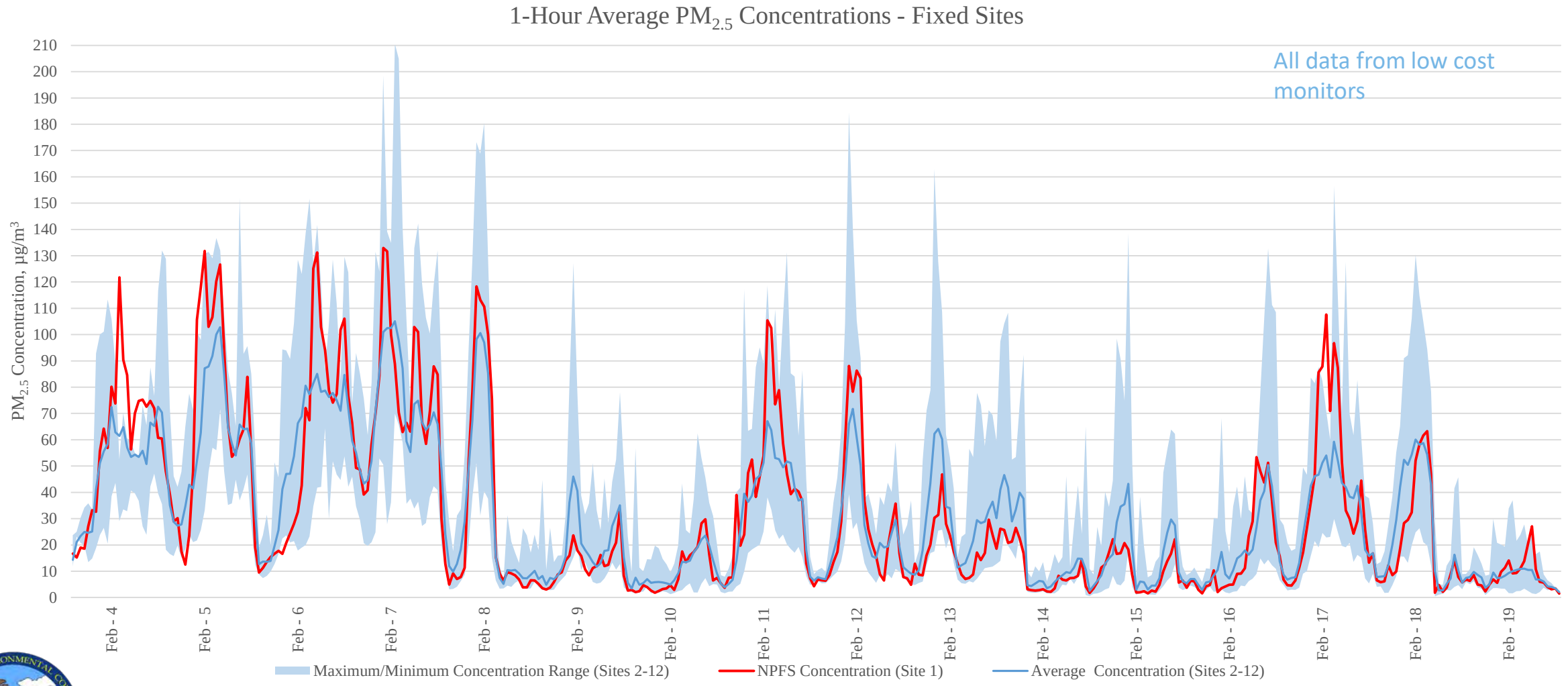
Temperature



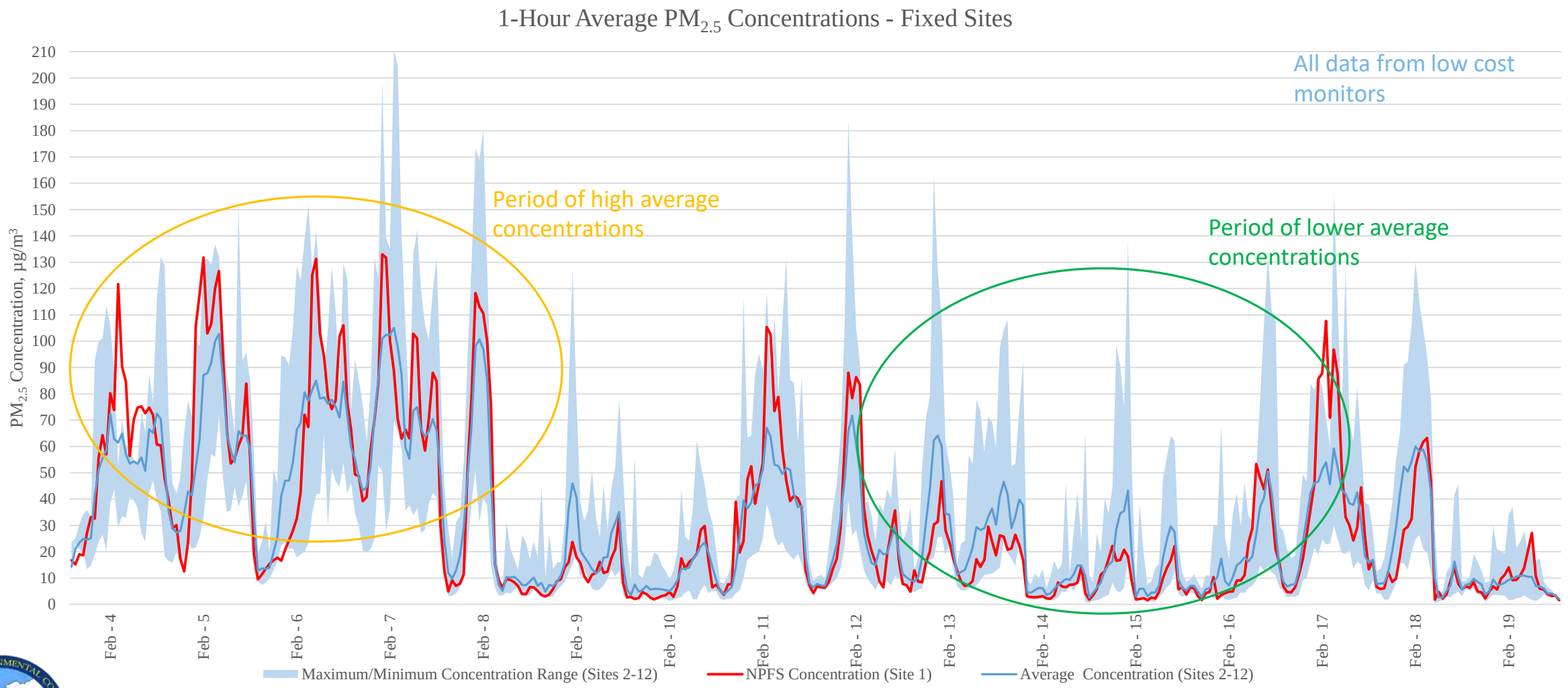
Results: Fixed Monitoring – 24 Hour Averages



Results: Fixed Monitoring – 1 Hour Averages



Results: Fixed Monitoring – 1 Hour Averages



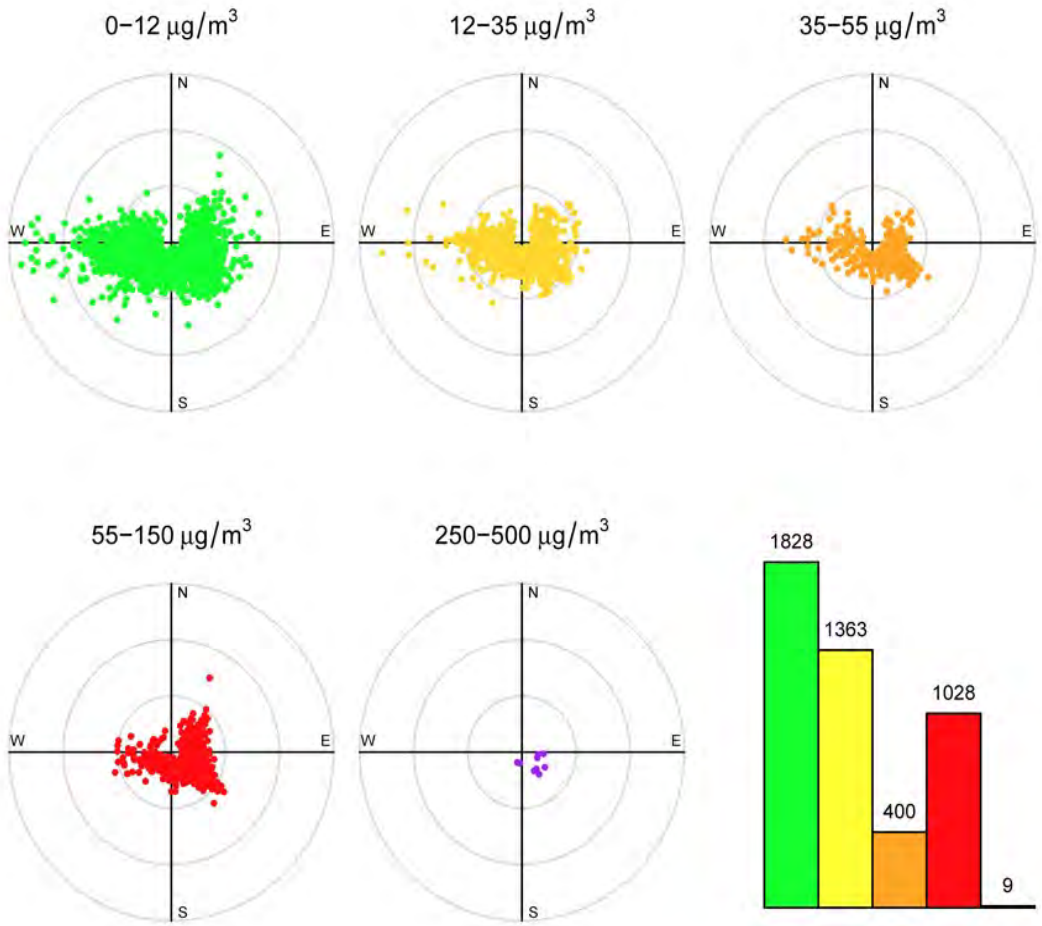
Fixed site Monitoring

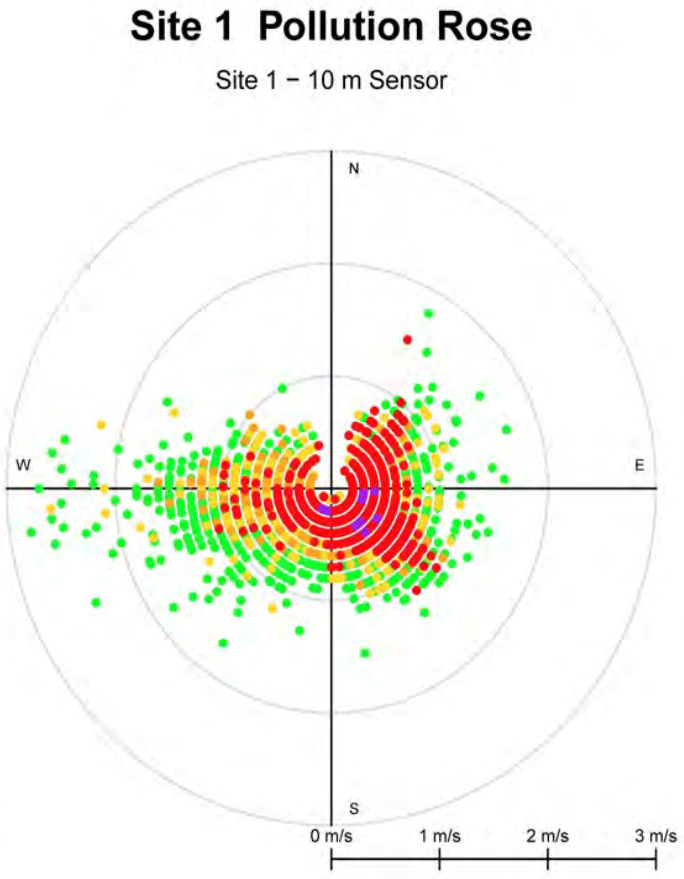
Relationship Between:

- 5-min Concentrations
- 5-min Wind Directions
- 5-min Wind Speeds

Observations:

- Northerly Winds Rare
- Winds <3 m/s
- Higher concentrations occur during periods with lower wind speeds
- Variation Between Sites
- All data from low cost monitors





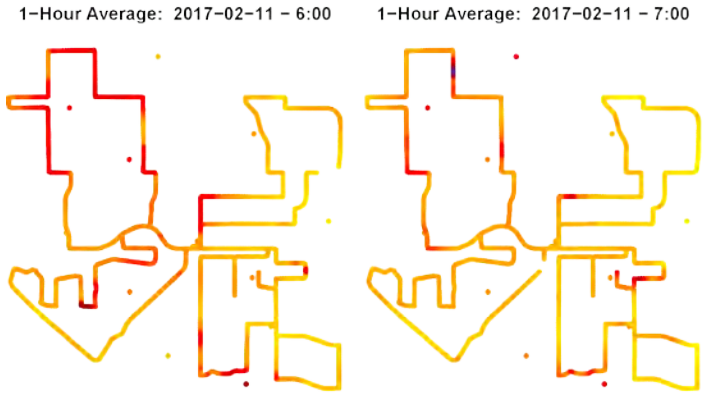
Mobile Monitoring

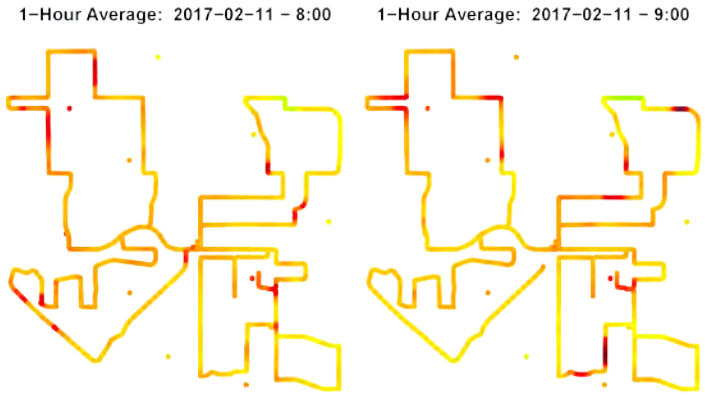
Saturday February 11 – Morning Run (6AM to 10AM)

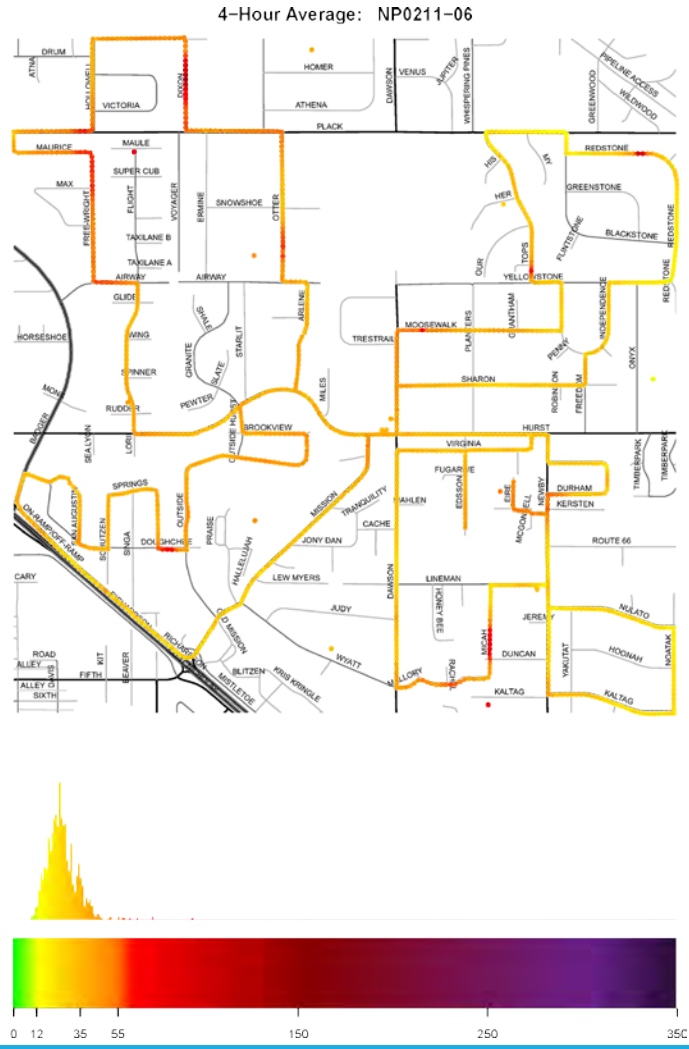
- 4 plots showing concentrations during each 1-hour traverse
- 1 plot showing 4-hour average concentrations of the traverses
- Histogram showing distribution of 4-hour average concentrations

Observations:

- Concentrations not homogenous throughout area
  - Indicates many individual sources
- Localized high concentrations
- Concentrations are transient
- Possible Causes:
  - Inversion layer lifting or forming
  - Behavioral Patterns
  - Dispersion of $PM_{2.5}$







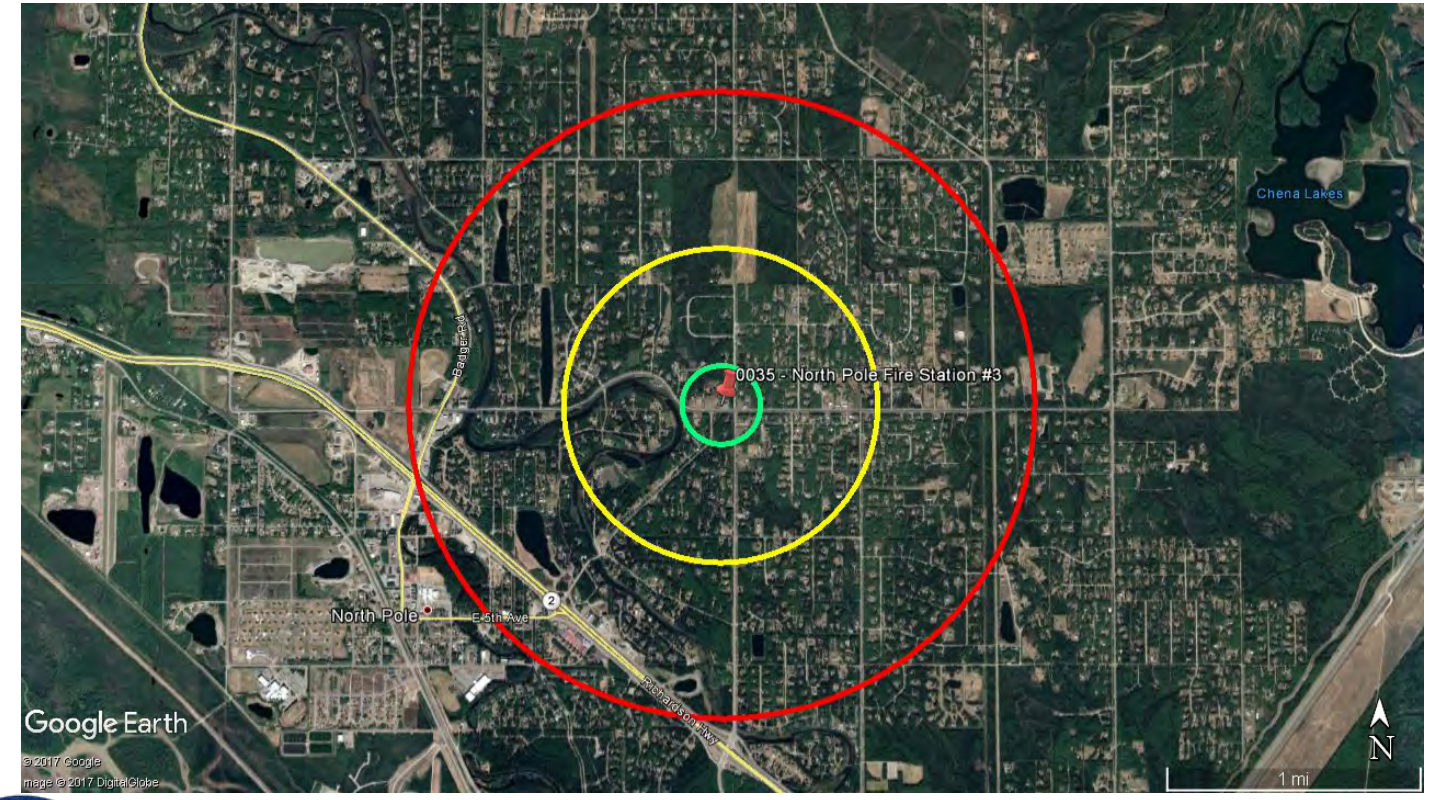
‘Virtual sites’ vs Sniffer map analysis

- **Similarities**
  - Road concentration maps look similar
  - Second or minute data
- **Differences**
  - Filling in information in between fixed sites
  - 3 main time periods
  - More robust analysis, by averaging the 4 sequential hourly drive data
  - Able to catch variability of weather and emission patterns
  - Cannot equate mobile data to 24 hour averaged data

Saturation Study Objective:

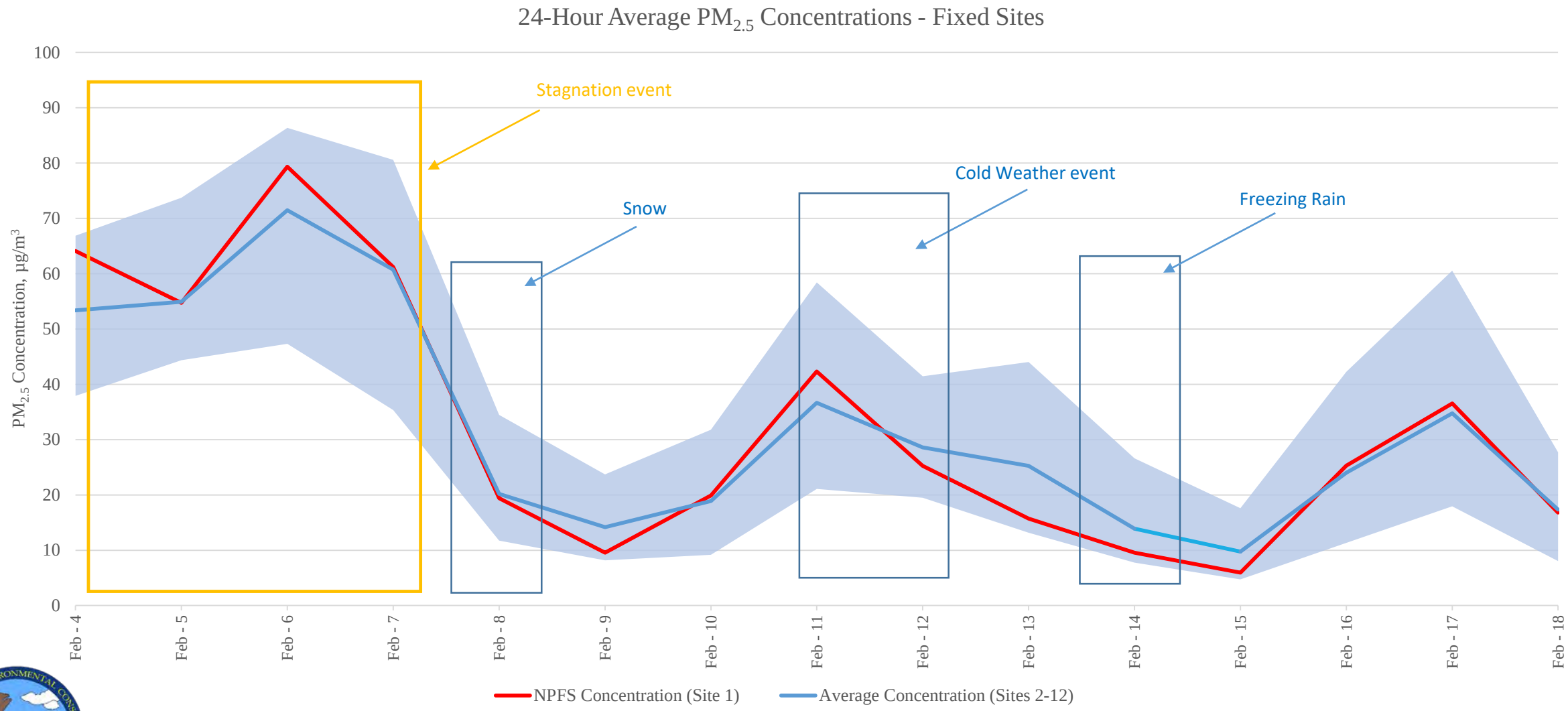
Is the NPFS monitoring site representative for the area?

Conclusions - scale



Study Condition	Days
Number of Exceedance Days (NPFS 24-Hr Avg. ≥ 35 µg/m³)	6
Number of Cold Days (Minimum Temp ≤ -15°F)	7

Conclusions - representative



Conclusions

- Problem more widespread than indicated by FNSB sniffer program maps
- North Pole Fire Station Site does not record the highest values or the lowest
  - **somewhere in the middle**
- Data indicate many individual localized sources of pollution, reaffirming conclusion that it is primarily local sources including woodstoves that contribute to high concentrations and not large stationary sources outside of study area
- Fairly representative of study area concentrations
- **The data from this study does not support the need to relocate the NPFS regulatory monitoring site**.

Contact Information

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http://dec.alaska.gov/air/north-pole-study.htm