Executive Summary

The Puget Sound Clean Air Agency recently completed a winter monitoring study to better characterize pollution levels in parts of South King County and Pierce County. The Agency monitored fine particulate pollution (PM 2.5), which is a complex mixture of extremely small particles and liquid droplets that are 2.5 micrometers in diameter and smaller[1]. PM 2.5 degrades air quality and visibility, and is linked to health effects such as premature death, heart attacks, aggravated asthma, and decreased respiratory function[2].

The Agency monitors PM 2.5 throughout Puget Sound, but has not recently monitored in parts of King and Pierce County. This monitoring study helped the Agency understand PM 2.5 levels to better assess the reach of our current monitoring network, inform burn ban forecasts, and assess model performance.

Historical data has shown that PM 2.5 levels are highest during the winter months, when strong inversions typically occur. The Puget Sound Clean Air Agency used temporary samplers to characterize air quality patterns in King and Pierce County from November 2012 to February 2013.

The Agency collected data at each of these monitoring stations with a nephelometer. The nephelometer measures light scattering, which is commonly used in Washington as a surrogate to estimate fine particulate matter (PM 2.5) concentration. The data collected is non-regulatory in nature, but is useful for characterizing high pollution days when a temperature inversion traps concentrated PM 2.5.

The Agency collected data at nine temporary monitoring sites. Three temporary sites were located in King County. Six temporary sites were located in Pierce County. Temporary monitoring sites are subject to more variation than fixed monitoring sites. The operators attempted to limit the effects of this variation by controlling for site scale, site temperature fluctuations, and variation in instrument calibrations. The data quality was acceptable at 8 of the 9 temporary sites. The Bonney Lake monitor was eliminated from the analysis because of poor data quality.

The fixed monitoring sites used in this study included one site in King County, four in Pierce County, and one in Kitsap County. All monitoring sites are mapped on Figure 1 (fixed in orange, temporary in green).

[1] http://www.epa.gov/pm/
[2] http://www.epa.gov/pm/health.html

Figure 1. Monitoring Sites Evaluated.

Since there were nine temporary sites and only six nephelometers available for the study period, the Agency operated some temporary sites during the first half of the wood smoke season, and then moved those sites to other temporary locations during the second half of the wood smoke season. Two distinct time periods were analyzed.

Figure 2 (below) shows estimated PM 2.5 concentration Mean and Variability of the 8 highest days during the first of the two time periods. King County sites are listed on the left, Pierce county sites are listed in the center and on the right. We chose the 8 highest days to display for some level of consistency with the value that is used to compare to the daily health-based national ambient air quality standard (NAAQS). More information about the PM 2.5 standard can be obtained at this link. http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html

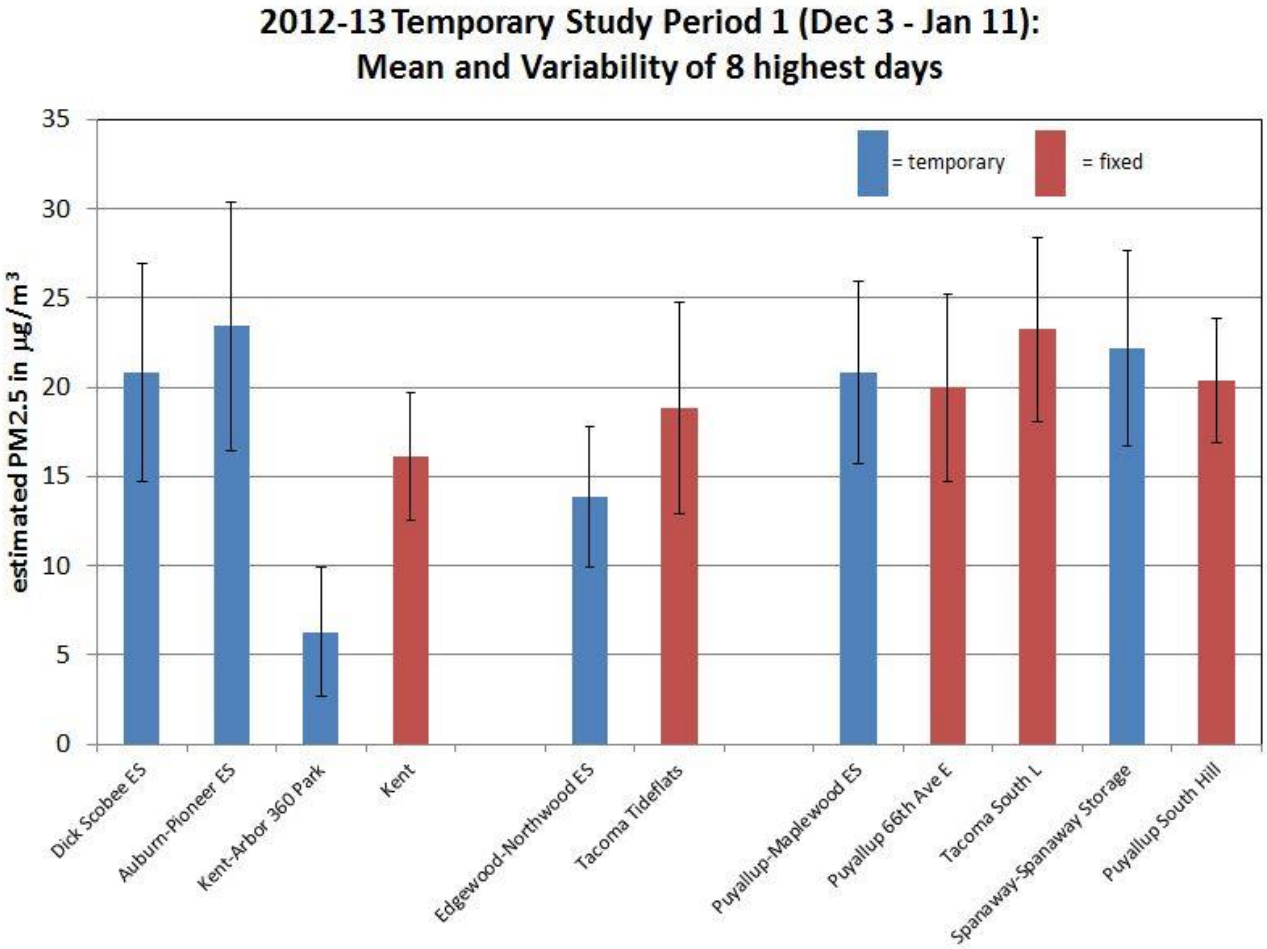

Figure 2. Period 1 Site Comparison.

Figure 3 (below) shows estimated PM 2.5 concentration Mean and Variability of the 8 highest days during the second time period analyzed. King county sites are on the left, and Pierce county sites are on the right.

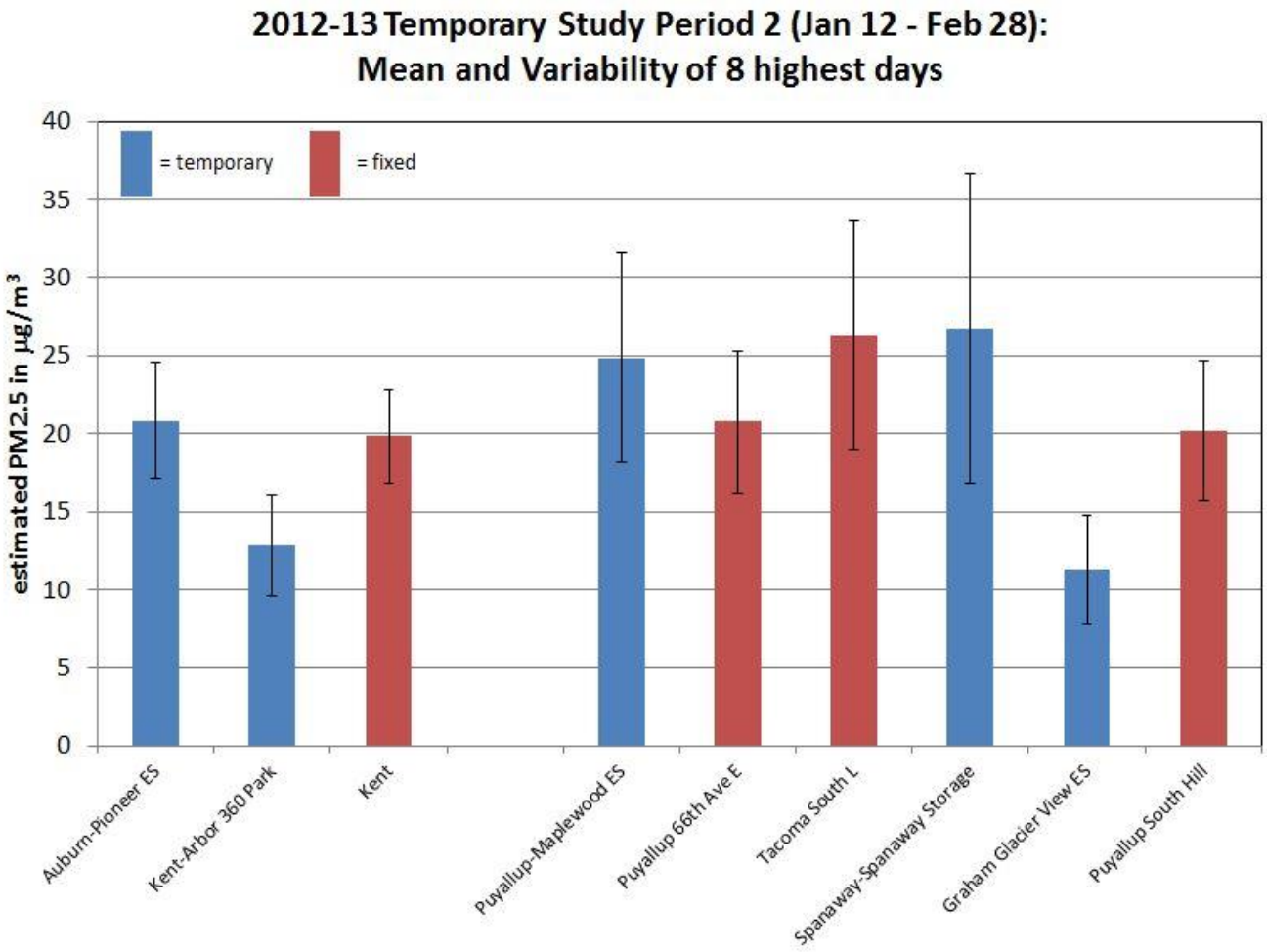

Figure 3. Period 2 Site Comparison.

The Agency conducted data analysis using summary statistics, regressions, difference analyses, and quality assurance precision estimates. While significant error exists in the results, based on all of the data analyzed, several observations were made.

1. Light scattering readings at the Auburn temporary sites more closely correlated with the Kent monitoring site. The light scattering levels, however, were higher than Kent, and were closer to Tacoma South L levels during the first half of the study.

2. Temporary sites that were located at a higher elevation than the closest fixed site (Kent – Arbor 360 Park, Edgewood, and Graham) showed generally lower levels. This confirms our understanding of how topography affects fine particle concentrations.

3. Temporary sites in Spanaway, and Puyallup very closely correlated with other Pierce county monitoring sites.

4. The highest levels of fine particle pollution occurred at Tacoma South L, Spanaway, Auburn Pioneer, and Puyallup Maplewood stations. The temporary samplers did not show any unknown hot spots. These locations have common demographic and topographic features, such as high home density, presence of wood burners, lower elevation, and the presence of economically challenged communities.

5. Although we had a limited data set, the Gig Harbor site showed lower levels compared to other Pierce county sites. The Gig Harbor site was most closely associated with the Tacoma Alexander (Tideflats) monitor, but that association was only moderate.

6. The Bonney Lake site had shelter heater problems and was erroneously sited with regard to scale, and did not provide enough valid data to make any conclusions. More sampling would be needed to characterize Bonney Lake.

Additional discussion and data is presented in the technical report. We encourage you to bring your questions to the Agency by contacting the Project Manager, Matt Harper at matth@pscleanair.org or (206) 689-4009.

END OF EXECUTIVE SUMMARY