

APPENDIX F

LPAHs Data Analysis

APPENDIX F: LPAH FLUX

Utilizing the sampling methods described within this report, LPAH bulk deposition results are anticipated to be biased low. The 2-4 weeks deployment period allows for volatilization to occur from the open sample container. The bulk air deposition sampler does not include a surface, such as a foam plug, designed to absorb gaseous phase PAHs. This bias impacts LPAHs most due to their high volatility, and is not believed to substantially impact the assessment of HPAHs which are less volatile.

Low bias from volatilization was demonstrated by quality control sample results in King County's main atmospheric deposition study (King County 2013a). Poor recovery of LPAHs using bulk atmospheric deposition sampling techniques has also been observed by other researchers (King County 2008, King County/Seattle 2005, Brandenberger et al. 2010). Because of this low bias, the bulk atmospheric deposition data for LPAHs collected in this study should not be used as an absolute estimate of deposition (such as loading estimates). However, these data are included in this appendix because the results are valuable for spatial comparison (relative deposition rates between sites).

2013 LPAH Flux

Seventeen PAH samples were collected at the Beacon Hill and Georgetown stations in 2013 and analyzed for LPAHs. LPAH fluxes at Beacon Hill station ranged from 0.05 to 0.25 $\mu\text{g}/\text{m}^2\text{-day}$ and the mean and median were both 0.13 $\mu\text{g}/\text{m}^2\text{-day}$ (Table F-1). In comparison, LPAH fluxes at Georgetown station were observed at a greater range (0.05 to 0.43 $\mu\text{g}/\text{m}^2\text{-day}$), with a mean and median of 0.22 and 0.21 $\mu\text{g}/\text{m}^2\text{-day}$, respectively. The similarity of mean and median at both sites indicate similarity to a normal distribution with little skewness.

Table F-1. 2013 LPAH flux

Station	Beacon Hill	Georgetown
Sample Size	17	17
Minimum	0.05	0.05
Maximum	0.25	0.43
Median	0.13	0.21
Mean	0.13	0.22

Similar to HPAH flux, average LPAH fluxes were higher at Georgetown than at Beacon Hill station (Figure F-1). LPAH fluxes were less variable at Beacon Hill compared to Georgetown. Temporal patterns in LPAH flux are also similar to reported HPAH flux, with the highest rates observed in fall through spring and lowest during mid-summer. Overall, the data suggest higher winter and lower summer LPAH fluxes.

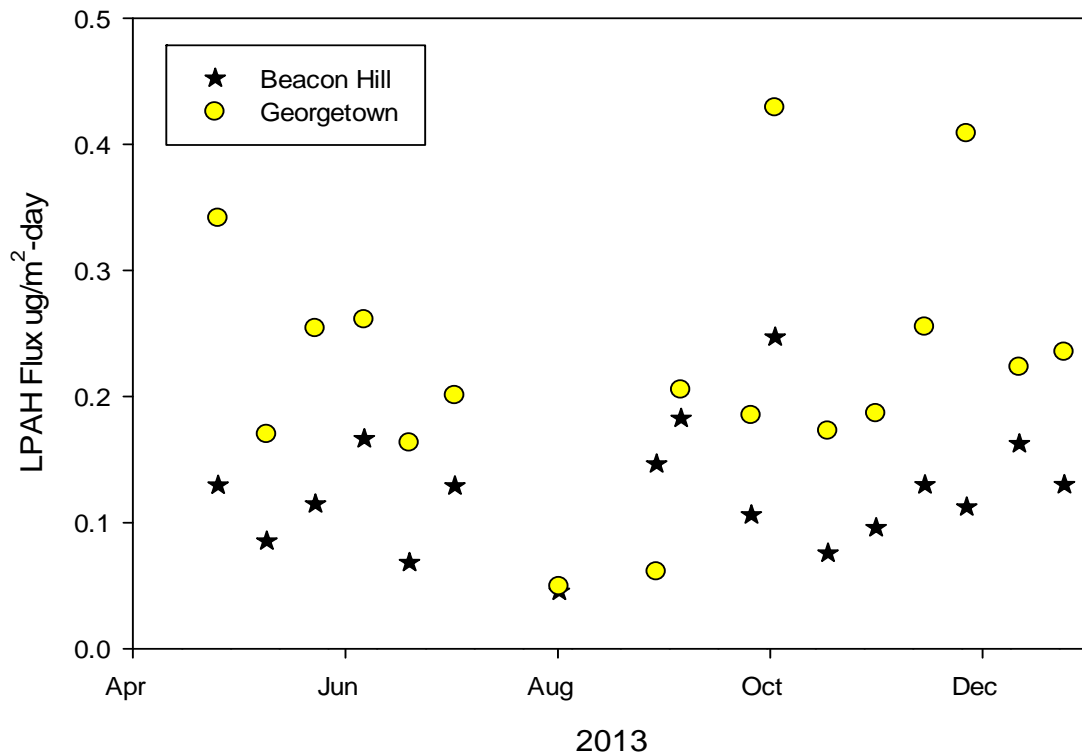


Figure F-1. LPAH Flux for Each Collection Period by Collection Date and Station

1.1.1 LPAH Flux - All Data

The LPAH flux data from the 2011/2012 and 2013 studies were combined to examine overall ranges and spatial patterns. Median LPAH flux was lowest at Enumclaw and highest at Kent (Table F-2).

The maximum observed fluxes ranged from 0.240 $\mu\text{g}/\text{m}^2\text{-day}$ at Enumclaw, to 0.968 $\mu\text{g}/\text{m}^2\text{-day}$ at Kent, although the Duwamish site maximum flux was nearly as high at 0.913 $\mu\text{g}/\text{m}^2\text{-day}$. Minimum values were less variable, and ranged from 0.017 $\mu\text{g}/\text{m}^2\text{-day}$ at Enumclaw to 0.080 $\mu\text{g}/\text{m}^2\text{-day}$ at Kent.

Table F-2 Summary of All LPAH Flux Data (2011 – 2013) by Station ($\mu\text{g}/\text{m}^2\text{-day}$)

Station	Beacon Hill	Duwamish	Georgetown	South Park	Kent	Kent SC	Enumclaw
Sample Size	39	25	17	24	25	7	21
Minimum	0.038	0.052	0.049	0.048	0.080	0.048	0.017
Maximum	0.377	0.913	0.429	0.453	0.968	0.405	0.240
Median	0.130	0.217	0.205	0.150	0.317	0.139	0.105
Mean	0.147	0.299	0.224	0.184	0.352	0.171	0.106

Figure F-2 displays boxplots of LPAH flux distributions by station with results of testing for significant differences between means. Variability in LPAH flux as indicated by the 5th and 95th percentiles was largest at Duwamish and Kent stations and lowest at Enumclaw station. ANOVA by ranks and post-hoc testing results indicate that median LPAH fluxes at Kent and Duwamish stations were significantly higher than at Beacon Hill and Enumclaw stations but, not significantly higher than at Georgetown, South Park or Kent SC. Median LPAH fluxes at Enumclaw were significantly lower than at Duwamish, Georgetown and Kent stations. Median LPAH fluxes at Beacon Hill, Georgetown, South Park, and Kent SC were not significantly different from each other.

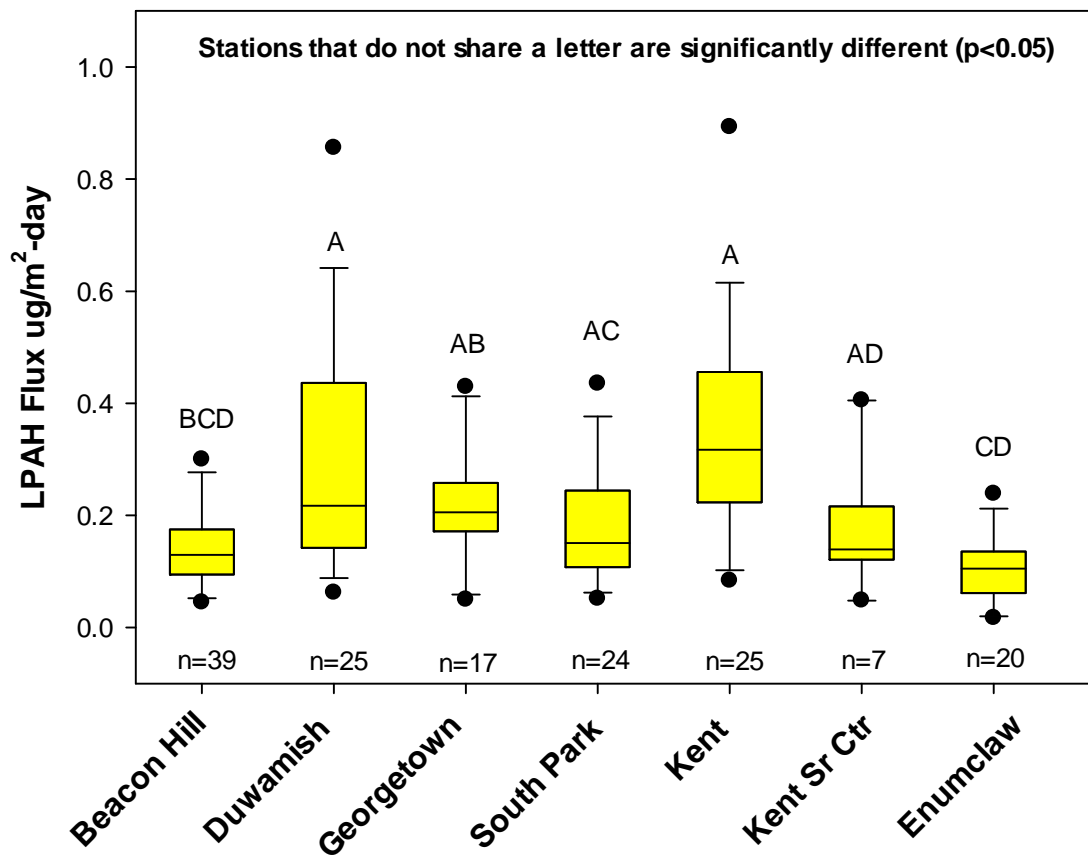


Figure F-2. Boxplots of LPAH Flux by Station