

MEMO

Project name **Air Quality Review of Rhode Island Department of Health (RIDOH) Air Monitoring at Rhode Island T.F. Green International Airport July 2020 – June 2021 Annual Report**

To **Rhode Island Airport Corporation (RIAC)**
From **Ramboll**

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1 Summary

While there is value in conducting data analyses and research for the purpose of analyzing regional air quality, it would be misleading and inaccurate to characterize data used in the Rhode Island Department of Health (RIDOH) Air Monitoring at Rhode Island T.F. Green International Airport July 2020 – June 2021 Annual Report (referred to hereafter as the RIDOH Report or “Report”) as conclusive representation of pollution caused by airport activities. The RIDOH Report uses a dataset to draw conclusions that are not supported regarding the contribution of Rhode Island T.F. Green International Airport (PVD) activities to ultrafine particle (UFP) pollutant levels. Additionally, the RIDOH Report alludes to health studies to be performed in the future, however health impact studies are not feasible based on the data available.

Conclusions in the RIDOH Report are not fully supported. The primary issues are summarized below:

- There are greater than 120,000,000 annual motor vehicles traveling on roadways in the immediate vicinity of the airport air monitors. A number of studies have shown that the PVD monitors are within expected UFP and black carbon (BC) atmospheric travel distance from these roadways and the contribution of these sources therefore need to be considered for any conclusions to be drawn.
- The RIDOH report asserts that there is a direct relationship between UFP counts and air traffic, yet a relationship has not been established (see Figures 2, 3, and 4 of this memorandum).
- There are four other monitors that are not in the vicinity of PVD. All four measure BC, and two measure UFPs. These monitors demonstrate there are lower BC concentrations than seen at the PVD monitors. For UFPs, one monitor on the CCRI campus, is not located downwind and from any major source and therefore likely represents a background level for UFPs. This CCRI monitor expectedly shows lower UFP counts than the PVD monitors. Since this monitor is a background representation it should not be used to subjectively imply a level of significance of the airport. The other UFP monitor (called Near Road) is located directly next to a major roadway and is therefore not comparable to the PVD monitors which are about 1,000 feet away from major sources. Still, the Near Road monitor does show UFP counts on the order of five times higher than the PVD monitors which is an indicator of the contribution of traffic to UFP levels. This monitor emphasizes the need to consider these emissions in a study to understand the context of the UFP counts at the PVD monitors before drawing conclusions.
- There was also a monitor that was previously used for PVD, the fire station (FS) monitor that was located within 2,000 feet of the airport. RIDOH determined this monitor was not representing airport activities, yet it has historically shown similar UFP counts to all other PVD monitors. RIAC

has also shown prior monitor data from 2017 (Figure 5 of this memorandum) that shows the PVD monitors have lower UFP counts than other locations in Rhode Island.

- Background pollution levels were never established. Therefore, without a baseline, any level of significance of airport-related emissions of UFPs cannot be determined from this study.

These main points demonstrate that that drawing conclusions from the RIDOH would be misleading.

2 Major Emission Sources are not Considered

Traffic is a known major source of UFPs, and the airport is surrounded by roadways that have more than 120,000,000 vehicles travelling annually. This traffic is often congested with delays at intersections and is a major source of air pollution. The RIDOH report does not include this important information. The RIDOH Report therefore does not provide representation or understanding of the major UFP or BC emission sources in the area.



Figure 1. Locations of major roadways near PVD and average daily traffic (ADT), monitor locations, and distances from monitors to major roadways.

Figure 1 presents roadway distances relative to monitors and the average daily traffic (ADT). The nearby roadways shown in the figure have traffic counts of over 20,000 ADT. Several studies^{1,2,3} demonstrate that traffic emissions are substantially impactful on UFP counts near major roadways and that traffic related UFP emissions can travel distances of half a mile to over three miles. A number of studies^{4,5} also

¹ Health Effects Institute (HEI). HEI Perspectives. Vol. 3. HEI; Boston, MA: 2013. HEI Review Panel on Ultrafine Particles. Understanding the Health Effects of Ambient Ultrafine Particles.

² Larson, Timothy, et al. "Ambient air quality measurements from a continuously moving mobile platform: Estimation of area-wide, fuel-based, mobile source emission factors using absolute principal component scores." Atmospheric Environment 152 (2017): 201-211.

³ Riley, E. A.; Banks, L.; Fintzi, J.; Gould, T. R.; Hartin, K.; Schaal, L.; Davey, M.; Sheppard, L.; Larson, T.; Yost, M. G., Multi-pollutant mobile platform measurements of air pollutants adjacent to a major roadway. Atmos. Environ. 2014, 98, 492-499

⁴ University of Washington Department of Environmental & Occupational Health Sciences. Mobile ObserVations of Ultrafine Particles: The MOV-UP study report. Seattle; 2019.

⁵ Using mobile monitoring to characterize roadway and aircraft contributions to ultrafine particle concentrations near a mid-sized airport, Atmospheric Environment, Hsiao-Hsien Hsu, Gary Adamkiewicz, E. Andres Houseman, John D. Spengler, Jonathan I. Levy, Volume 89, 2014, Pages 688-695,

show that assessing relative contributions from aircraft activities and motor vehicle traffic is highly difficult given the differing time scales. Six of the seven major roadways in **Figure 1** are within less than a mile of all monitors, and the substantially traffic heavy I-95 is approximately 1.5 miles from the Fieldview monitor. All major roadways are well within expected travel distances to monitors for UFPs. Therefore, without the consideration of traffic-related emissions, conclusions regarding significance of airport-related emission contributions cannot be drawn.

3 Statistical Analysis does not Demonstrate Causation

From the RIDOH Report’s data and analysis, a relationship could not be established between airport activities and UFP counts at the monitors. Additionally, potential impacts in the surrounding community should not be asserted from the data available. The RIDOH Report should not discuss a causal relationship between flight activity and UFP or BC levels. Statements such as “particle counts were higher when wind directions were from the airport to a given sensor and lower when the wind blew towards the airport, which is expected if the airport is a major source of ultrafine particles”, and “while the nearby airport is a major factor for particle count measurements” should be removed as they are subjective determinations of the airport as a “major” source because they are without context of traffic emissions and other sources. These statements are not supported by the statistical analyses from the RIDOH report; the corresponding issues are discussed in more detail below.

3.a. Average Annual Data Results do not Show a Relationship between UFP and Operations

The RIDOH Report demonstrates that there is no direct relationship between average daily operations and UFP counts. Figure 6 of the RIDOH Report (shown in **Figure 2** of this memorandum) presents average hourly UFP counts for the time period of reporting. The graph shows peaks occurring early in the morning (i.e., around 6 am) and later in the evening (i.e., around 8 pm), with lower mid-day levels. These peaks correspond to expected roadway traffic activities during morning and evening rush hours and not with aircraft operations for PVD. The operational aircraft activity shown in Figure 7 of the RIDHO report (also shown in **Figure 2** here) peaks around mid-day (12 pm to 2 pm) and this is the opposite of what is seen for UFPs on this timescale. These curves are not related to one another and indicate that UFP counts are largely driven by parameters other than flight activity.

3.b. Monitored Pollutant Levels Compared to Meteorological Parameters

The RIDOH Report notes that when monitors are “downwind of the airport”, UFP counts are higher than when they are upwind, and that this is not the case for BC concentrations. The RIDOH Report uses this finding to conclude that “the airport is a major source of UFPs”. This should not be stated as significance of the airport UFP emissions has not determined from the RIDOH analysis. Data presented in the RIDOH Report (Figure 44) for a monitor in

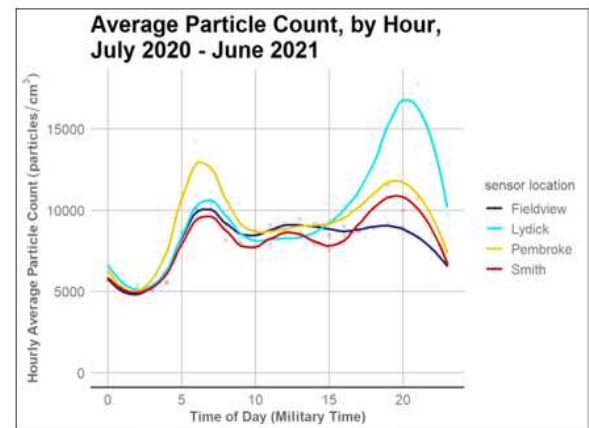


Figure 6: Average hourly ultrafine particle count followed a consistent trend across the sites, with a strong peak in morning and the evening, accompanied by subsequent decreases during midday and in the early morning. There was more variability between locations for particle count than was observed for black carbon, and the midday dip was much less pronounced.

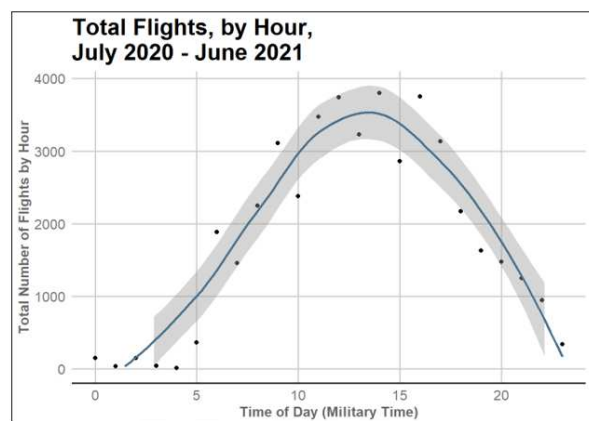


Figure 7: Flight activity by hour of the day exhibited a peak in early afternoon and almost no flights between midnight and five AM.

Figure 2. Figures 6 and 7 of the Report demonstrating no relationship between average daily operations and UFP counts.

Providence located in the immediate vicinity of the I-95 reports UFP counts on the order of five times larger than the monitors at PVD. This monitor demonstrates the magnitude of traffic's impacts on UFPs, and this type of context is not discussed in the RIDOH report.

3.c. Monitored Pollutant Levels Compared to Operations Does Not Show Causation

The RIDOH Report attempts to investigate if there is a relationship between daily operations and pollutant levels at each monitor site. For BC, the RIDOH Report demonstrates that they have found there is a statistically significant correlation shown between each monitor's BC concentrations and flight activity. However, there are low r-squared values for indicating high levels of variability and influence from other sources. The RIDOH report used this finding to label PVD a "minor contributor" to BC, however a causal relationship cannot be determined from the RIDOH analysis. BC has an atmospheric lifetime of four to 12 days and is attributable to many sources, traffic in particular. The airport's contribution to BC at these monitors cannot be proven or disproven based on the data shown in the RIDOH report.

Regarding UFPs, the RIDOH report has consistently used the term "major" to describe PVD as an emission source of UFPs. However, the use of the word "major" is subjective and the level of significance is not demonstrated. For UFPs, two monitors are demonstrated by RIDOH to be correlated to flight activities, and both are shown by RIDOH to have low r-squared values indicating there is substantial variability in the dataset. These results do not demonstrate the level of significance of PVD emissions on UFP counts yet the RIDOH report uses their results to arbitrarily label PVD as "major" when this is not proven in their data. From the data shown in the RIDOH Report, there are no conclusions that can be drawn or stated regarding a relationship between UFPs and airport activity nor can a subjective level of significance (i.e., minor or major) be established for BC or UFP based on the data presented.

To investigate if operations have impacts on UFPs further, Ramboll has reviewed data from a typical day, June 15th, 2022, shown in **Figure 3**. The analysis demonstrates that for this dataset (i) the majority of operations were not affiliated with a UFP spike at any monitor, (ii) frequency of operations is not related to UFP counts, and (iii) operational occurrences cannot be used to predict UFP counts.

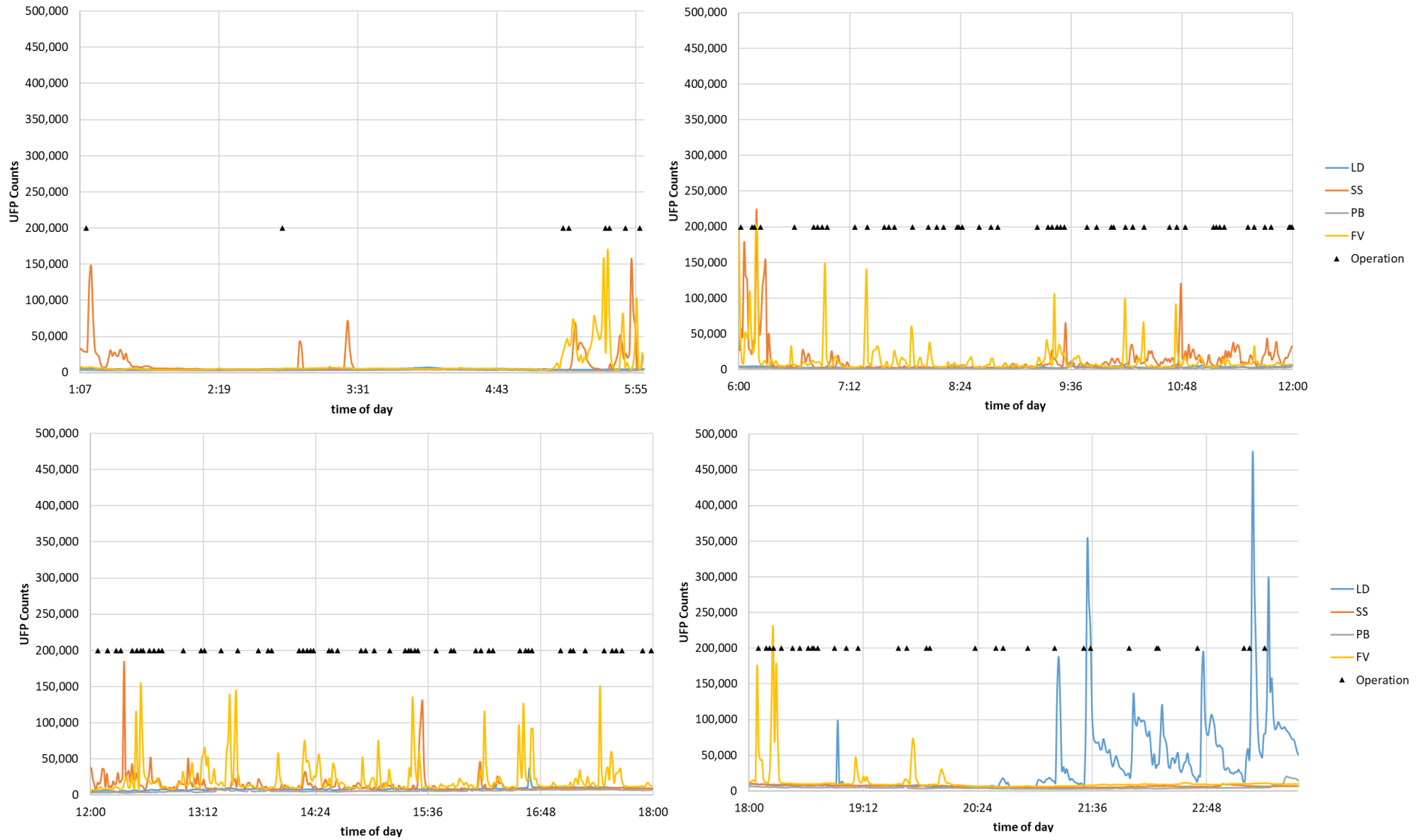


Figure 3. UFP counts for PVD monitors Lydick (LD), Smith Street (SS), Pembroke (PB), and Fieldview (FV) for June 15, 2022. Operations are marked by black triangles and data is presented in six-hour intervals for visual clarity.

4 PVD Pollutant Levels are Similar or Lower than Other Monitors in Rhode Island

Other monitors and historical data demonstrate a lack of direct impact of airport activities on the PVD monitored UFP counts. In order to fully understand PVD’s activities relative to UFP and BC pollutant levels, a longer-term monitoring dataset was analyzed, and findings were documented in the 2021 technical memorandum “COVID-19 Air Quality Monitoring Data Analysis”.⁶ As demonstrated in **Figure 4**, the analysis found that there was no significant relationship between UFPs and aircraft operations during the time period investigated. It is particularly noteworthy that, during the pandemic’s beginning when there was an unprecedented drop in aircraft activities, UFP counts remained at normal levels.

A PVD monitor that was formerly in use near the airport, the Fire Station (FS) monitor, lends useful information regarding other nearby and background sources. RIDOH had determined that “since the Fire Station monitors have not yielded conclusive data about airport impacts” RIDOH recommended that the FS location be discontinued.⁷ FS was taken offline in December 2019 because RIDOH determined it was not reflecting airport activities, meaning it was representative of background and other nearby sources. It is noteworthy that the UFP counts at FS, shown in **Figure 4**, are similar to all other monitors near PVD. This is further evidence that nearby emission sources other than the airport are likely the significant drivers in UFP counts at PVD monitors.

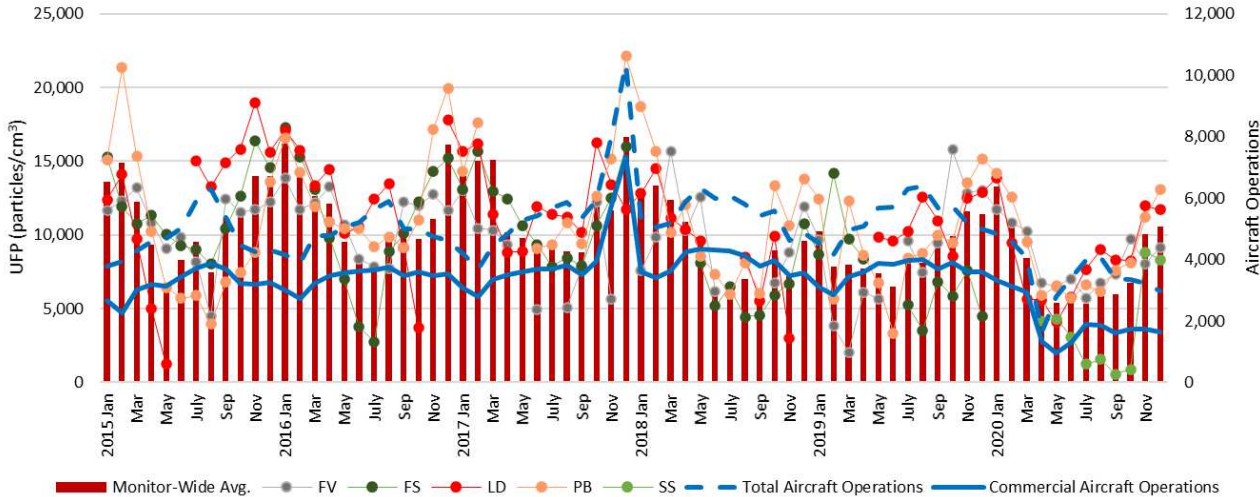
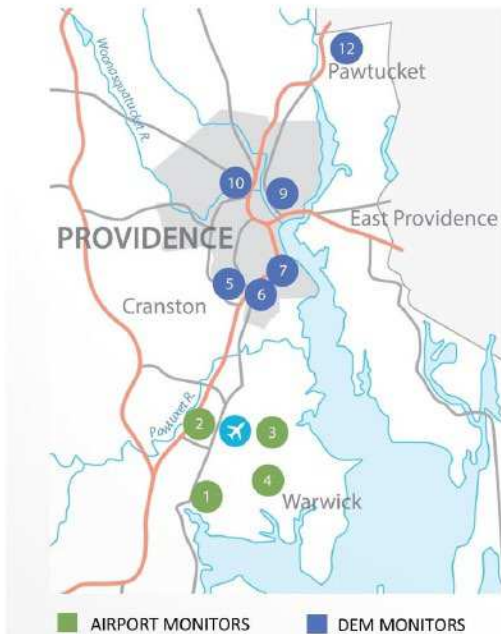


Figure 4. All Monitors Monthly Average UFP Counts and Aircraft Operations

Lastly, RIAC has previously demonstrated using monitor data from 2017 that the UFP counts seen at the other monitors in Rhode Island have higher particle counts than those seen at PVD. This is demonstrated in **Figure 5** as provided by RIAC below.⁸

⁶ COVID-19 Air Quality Monitoring Data Analysis, Crawford, Murphy & Tilly (CMT), 2021
⁷ Air Monitoring at Rhode Island T.F. Green International Airport Annual Report, September 2017
⁸ Figure 5 was obtained from presentation material provided by RIAC.



2017 ANNUAL AIR POLLUTION

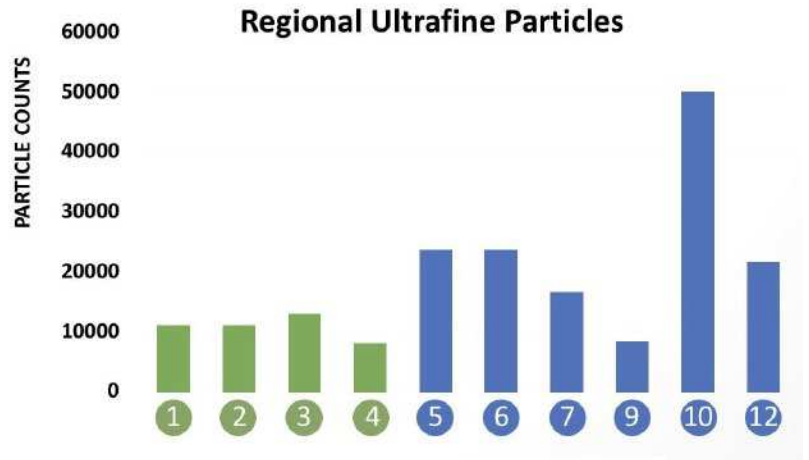


Figure 5. UFP counts from monitors in Providence compared to PVD monitors from 2017.

5 Conclusion

This memorandum presented several issues regarding the conclusions of the RIDOH Report that are not substantiated by the analysis performed. The RIDOH Report results cannot be used to imply that PVD is the major source of UFP emissions compared to other emissions sources nor that there could be potential health impacts from the airport driven by UFP counts. There were consistent references in the RIDOH Report to potential future health studies, however the data presented does not provide any indication of impacts on local health. Furthermore, health impact thresholds have not yet been determined for BC or UFPs, and there would not be any health metric that could be used for comparison; therefore, such references must be removed.