Statistically significant correlations were discovered between total vehicle count and both ozone and noise during non-operational hours at Station 4 (Church Street) and between total truck count and noise during non-operational hours at Station 4 (Church Street).

Appendix A.8 presents the calculated correlation coefficients and provides additional information about the strengths of the correlations.

# 6 CONCLUSIONS

After evaluating all twelve of the parameters through six different perspectives, we have considered the weight of the evidence to present a hierarchical ranking scheme.

*1st Tier Parameters*

We recommend prioritizing nitric oxide and formaldehyde as parameters of greatest interest for any future work. Formaldehyde and nitric oxide exhibited a greater frequency of outlier data points in comparison to other parameters. Further, the average exposure ranking index values calculated for nitric oxide and formaldehyde were greater than two when concentrations measured at Station 4 (Church Street) were compared against those measured at the control station (i.e., Station 5 (Twiggs Park)). These reasons form the basis for our recommendation to prioritize these parameters over the others evaluated in this study.

*2nd Tier Parameters*

We recommend considering sulfur dioxide, carbon monoxide, noise, Volatile Organic Compounds, nitrogen dioxide, and methyl mercaptan as parameters of secondary interest for any future work. These parameters present some conflicting perspectives, depending upon the statistical approach considered, but did not present strong evidence for deprioritization. For example, Volatile Organic Compounds, nitrogen dioxide, and methyl mercaptan were found to have distributions which were statistically significant in the Study Area vs. control station analysis, but higher mean or median values were found in the "not downwind" direction from the site, which could suggest regional influences unrelated to the site. These parameters may benefit from evaluation of long-term trends in air quality in the future.

*Deprioritized Parameters*

Lastly, we recommend that ozone, fine and course particulate matter ($PM_{2.5}$ and $PM_{10}$) and hydrogen sulfide be deprioritized as parameters of least interest for any future work. Hydrogen sulfide was found to have no significant difference between the study Area and control station, nor any significant difference in the downwind vs. not-downwind directions within the Study Area. Fine and course particulate matter ($PM_{2.5}$ and $PM_{10}$) parameters produced negligible

correlations with traffic in the study area; the mean/median values for the distributions were higher in the not-downwind directions, suggesting non-site drivers for these parameters, and the average exposure index values calculated for all stations were below 0.80 at all locations when compared to the control location. Further, the hours of facility operation were not statistically significantly different than non-operating hours for fine particulate matter ($PM_{2.5}$) at Station 3 (Church Street Village) which was the station most removed from a roadway. Ozone appears to be statistically significant during operational hours primarily as an artifact of time with operating hours concurrent with sunlight hours, compounded with a moderately positive and greater correlation coefficient for all-vehicle traffic than truck traffic.

# 7 RECOMMENDATIONS

Considering that the primary goals of the project was to understand whether any of the target air quality parameters demonstrate probable source-attribution to site operations, so that such information could be taken into consideration for potential future evaluations, we present the following recommendations for consideration:

1. Formaldehyde and nitric oxide are the air quality parameters of greatest interest and should be prioritized in any future work. Sulfur dioxide, carbon monoxide, Volatile Organic Compounds, methyl mercaptan, nitrogen dioxide, and noise present lesser supporting evidence but may still warrant further investigation. Given the prominence of formaldehyde in our findings, it may be of interest to examine whether other specific Volatile Organic Compounds are present by conducting VOC speciation in any future work (e.g. toxic air pollutants listed in the Clean Air Act). We recommend deprioritizing hydrogen sulfide, fine and course particulate matter ($PM_{2.5}$, $PM_{10}$), and ozone parameters which appear to be related to regional air quality rather than local air quality. We should note that the International Agency for Research on Cancer classified formaldehyde as carcinogenic to humans in 2004 (i.e., Group 1) (IARC. 2012) and nitric oxide is a respiratory irritant (ATSDR, 2002) as documented in Table 1 on page 9 of this report.
2. To better understand whether the collected data represents harmful levels with the potential for adverse human health effects, a number of follow-up studies should be conducted.
    a. First, the monitors used for this study should be collocated with Federal Reference Method (FRM) or Federal Equivalent Method (FEM) equipment that is operated by the USEPA at air monitoring stations across Cook County, IL and used to monitor regional air quality. The collocated data from both monitors can then be analyzed to develop scaling (or correction) factors so that the data collected using

the low-cost real-time monitors during this study can then be adjusted and directly compared to data collected by the FRM/FEM at the EPA air monitoring stations. This will allow an assessment of whether concentrations measured in this study are within the range observed for regional air quality or whether the data represents a "hot spot" influenced by a local emission source such as the waste transfer station.

b. Secondly, the determination of compliance with the U.S. National Ambient Air Quality Standards (NAAQS) for criteria air pollutants (which are health-based standards) of interest for this study (ozone, nitrogen dioxide, $PM_{2.5}$/$PM_{10}$, carbon monoxide, sulfur dioxide) would require a long term air monitoring (one year or three years depending on the pollutant). The current study lasting for six months and serving as a scoping or screening-level assessment neither involved testing the performance of the monitors used against the USEPA's FRM/FEM monitors nor involved long-term monitoring. However, these studies can be undertaken in the future to assess potential health implications of the results presented in this report.

3. Furthermore, once scaling factors have been determined and applied to the data set, a Human Health Risk Assessment (HHRA) may be conducted to estimate potential human health risks. The health risk evaluation could employ estimation of Air Quality Index (AQI) for criteria air pollutants (ozone, nitrogen dioxide, $PM_{2.5}$/$PM_{10}$, carbon monoxide, sulfur dioxide) and would follow the four-step risk assessment paradigm developed by the National Academy of Sciences in 1983 for air toxics (e.g., formaldehyde). For air toxics, the HHRA would involve estimation of excess cancer and non-cancer health risks associated with inhalation exposures. This assessment would be performed only for toxic air pollutants (e.g., formaldehyde, benzene, and others) and represents a scientific approach to identifying those pollutants that drive the cancer and non-cancer risks for the exposed population. The findings of the AQI and the health risk evaluation would guide targeted exposure reduction and health risk reduction efforts through voluntary measures, regulatory programs, or strategically enacted community policies to improve air quality and public health.