Relationship Analysis between Select Indoor and Outdoor Pollutants in Milwaukee Area Offices

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Abstract

The six criteria air pollutants of $PM_{2.5}$, PM_{10}, NO_2, SO_2, O_3 and CO, as designated by the United States Environmental Protection Agency's National Ambient Air Quality Standards, were sampled with portable sensors three times weekly over a period of three months at five locations to determine a relationship between the indoor and outdoor air quality in the Greater Milwaukee Area. Data were catalogued, graphed, and processed through a regression analysis. After the analysis, data with an R^2 value of 0.4 or higher were considered as designating a significant relationship. Therefore, between indoor and outdoor air pollution, data only showed $PM_{2.5}$ to have a statistically important relationship; PM_{10}, and NO_2 had statistically non-important relationships; and SO_2, O_3 and CO had inconclusive relationships. After considering factors not addressed by this study, companies wishing to improve indoor air quality may wish to utilize a higher MERV rated filter to address $PM_{2.5}$ and PM_{10}; and employ NO_2 and/or SO_2 sensors to monitor levels of these gases. These gases were singled out as SO_2 was the only pollutant to exceed any NAAQS recommended levels indoor and NO_2 was nearly exceeding recommended levels.

Keywords: Indoor Air Quality (IAQ), air pollution, Milwaukee, Wisconsin, United States Environmental Protection Agency (EPA), National Ambient Air Quality Standards (NAAQS), CO, NO_2, O_3, $PM_{2.5}$, PM_{10}, SO_2

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Nomenclature

Symbols

° - degree

μg/m^3 – micrograms per cubic meter

% - percent

|| - parallel

Abbreviations

ADHD – Attention deficit hyperactivity disorder

AHU – Air handling unit

ASHAE – American Society of Heating and Air-Conditioning Engineers

ASHRAE – American Society of Heating, Refrigeration, and Air-Conditioning Engineers

ASRE – American Society of Refrigeration Engineers

BAS – Building automation system

BOCA – Building Officials and Code Administration

C – Celsius

CAV – Constant air volume

CFM – Cubic feet per minute

C_{in} - Indoor contamination levels

CO – Carbon monoxide

CO_2 – Carbon dioxide

C_{out} – Outdoor contamination levels

$C_{\dot{s}}$ - Indoor particle emission rate

DB – Dry bulb temperature

DNR – Department of Natural Resources

DP – Dew point temperature

EA – Exhaust air

EPA – Environmental Protection Agency; Environmental Protection Authority

F_{in} – Filtration Factor

GHG – Greenhouse gas

HVAC – Heating, ventilation and air-conditioning

I – Interstate highway

IAQ – Indoor air quality

IBC – International Building Code

ICBO – International Conference of Building Officials

ICC – International Code Council

I-Codes – International Codes [as in, codes published by the ICC]

IMC – International Mechanical Code

I/O Ratio – Indoor to outdoor ratio

MERV – Minimum efficiency ratio value

NAAQS – National Ambient Air Quality Standards

NEPA – National Environmental Protection Act

NO – Nitrogen monoxide

NO_2 – Nitrogen dioxide

NO_x – Nitrogen oxide

NSW EPA – New South Wales Environmental Protection Authority

O_3 – Ozone

OA – Outside air

OSHA – Occupational Safety and Health Administration

Pb – Lead

PM – Particulate matter

$PM_{2.5}$ – Particulate matter of a diameter of 2.5 microns or less

PM_{10} – Particulate matter of a diameter of 10 microns or less

ppb – Parts per billion

ppm – Parts per million

R^2 – Coefficient of determination

RA – Return air

RH – Relative humidity

RSP – Respirable suspended solids

RTU – Roof top unit

SA – Supply air

SBCCI – Southern Building Code Congress International

SF – Square foot

SO_2 – Sulfur dioxide

SPS – Safety and Professional Services

TA – Ambient air temperature

TSP – Total suspended solids

UFAD – Under floor air distribution

US or U.S. – United States

UV – Ultraviolet

vs - versus

VAV – Variable air volume

VOC – Volatile organic compound

WB – Wet bulb temperature

Relationship Analysis between Select Indoor and Outdoor Pollutants in Milwaukee Area Offices

This study aimed to develop a relationship between indoor and outdoor air pollution levels for criteria air pollutants that were regulated by the United States government because while the outdoor air regulations are enforceable, people spend most of their day indoors. After developing a relationship from collected data, it would be possible to determine different methods of improving the indoor air quality by comparing several medium sized offices located in the Greater Milwaukee Area and their air qualities.

Background

Regulations and Regulating Bodies

Building construction in Milwaukee must abide by codes and standards as determined by the City of Milwaukee. As is typical in the construction industry, the codes refer, in some aspect, to a more widely accepted and known code or standard. Codes and standards may be adopted wholly, or with amendments that are more restrictive. It should be noted that standards, in and of themselves, are not legally binding. However, a code may reference or call upon a standard, thus making the standard legally binding. The City of Milwaukee directly adopts the State of Wisconsin Building Code for Residential and Commercial Structures with no amendments, including the Wisconsin Mechanical Code (City of Milwaukee, 2016, August 29).

Wisconsin Mechanical Code. Wisconsin realized its first commercial building code in 1914. From there, the state issued many individual codes and regulations of the construction industry and industry employees, such as Wisconsin's first mechanical refrigeration code in 1918 and registration of all HVAC (Heating, Ventilation, and Air-Conditioning) contractors

(Wisconsin Department of Commerce, 1999, December). After several years of consideration, Wisconsin's first adoption of model commercial building codes was International Building Code (IBC), International Mechanical Code (IMC), and several other codes published by the International Code Council (ICC), with state amendments, in 2002 (Wisconsin Department of Commerce, 1999, December). Since September 1, 2011, Wisconsin has formally adopted, with state amendments, the 2009 IBC, IMC, and other ICC issued codes (Alliance Regulatory Coordination, 2017, January 2).

Current amendments from Wisconsin are issued by the Legislative Reference Bureau under Safety and Professional Services (SPS). Commercial mechanical systems are addressed by Chapter SPS 364: Heating, Ventilating and Air-Conditioning (Legislative Reference Bureau, 2015, October 1). SPS 364.0401 states that the "mechanical ventilation shall be in accordance with IMC section 403 and as modified in [applicable subsections of this amendment]" (Legislative Reference Bureau, 2015, October 1, SPS 364.0401.1.a.2). A Wisconsin amendment can be exemplified in that mechanical systems must be designed to supply 7.5 cubic feet per minute (CFM) of outside air (OA) per person for the designed maximum occupancy according to provided charts. Outside air is required to be brought into a building to provide presumably clean air that will dilute indoor air contaminants. This required volumetric flow rate may be reduced if the actual maximum occupancy can be proved less than charted maximum occupancy, or

> where it can be demonstrated that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding the maximum obtainable by providing the rate of outdoor air ventilation determined in accordance with IMC section 403.3

with or without the modifications provided by the applicable subsections (Legislative Reference Bureau, 2015, October 1, Chapter SPS 364.0403.1.a). Of the two options for reducing CFM OA required, the prior is regularly used and the latter is infrequently used in current industry practice. A further requirement enacted by SPS 364 is that "the outdoor air shall be free from contamination of any kind in proportions detrimental to the health and comfort of the general population exposed to it" (Legislative Reference Bureau, 2015, October 1, Chapter SPS 364.0403.1.b).

International Mechanical Code. The International Code Council (ICC) was an effort by several organizations to decrease duplication and amalgamate code producing efforts. Building Officials and Code Administration (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International (SBCCI), established the ICC in 1994. The first editions of the IMC and IBC were published in 1996 and 1997, respectively. After the publication of the 2000 Code, the three tributary organizations agreed to end development of their respective codes and adhere to the IBC. The ICC updates the codes every 3 years, with the most recent update in 2015 (Trombly, 2006, August 2; International Code Council, Inc., 2009, February). A portion of, or the entirety of, every state and several territories of the United States have adopted one or more of the fifteen International Codes (I-Codes) (International Code Council, 2017, March 1). Wisconsin currently follows the 2009 edition of the IMC. Under Chapter 4: Ventilation; Section 403: Mechanical Ventilation, the IMC refers to Appendix A of the 2004 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) Standard 62.1 as a means to determine the mechanical system ventilation efficiency. This efficiency value is a ratio that represents the effectiveness of a mechanical system to bring in outside air and remove return or exhaust air to reduce air contamination levels. Also under Section 403, when

> the registered design professional demonstrates that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the minimum required rate of outdoor air shall be reduced in accordance with such engineered system design. (International Code Council, Inc., 2009, February, Section 403.2, par. 2)

ASHRAE Standard 62.1 can be used to demonstrate such an engineered ventilation system design.

American Society of Heating, Refrigeration, and Air-Conditioning Engineers. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) was founded by the merging of the American Society of Refrigeration Engineers (ASRE) and the American Society of Heating and Air-Conditioning Engineers (ASHAE) on January 29, 1959. The merger was well-supported by both organizations, as they realized the potential of a consolidated group (ASHRAE Centennial Committee, 2005, January 1). ASHRAE first published Standard 62.1: Ventilation for Acceptable Indoor Air Quality as Standard 62 in 1973. Similar to the ICC, ASHRAE typically updates the standards every 3 years. The most recent update released was in 2016. ASHRAE now stands as the industry's standard of care in responsibly HVAC design. The current adopted codes applicable in Wisconsin reference ASHRAE Standard 62.1 – 2004. Through a series of references within the standard, Table I-1: National Ambient Air Quality Standards (NAAQS) is mentioned (ASHRAE Standing Standard

Project Committee 62.1, 2010). The NAAQS is issued by the United States federal government through the Environmental Protection Agency (EPA). It should be noted that the most recent version of the NAAQS is applicable, even though ASHRAE Standard 62.1-2004 references an older version. This is because the state of Wisconsin is subject to the federal code on air quality, separate from the adherence to the building codes referring the federal regulation. Therefore, only the most recent version of the NAAQS will be referenced in this study.

Environmental Protection Agency. In 1969, Congress passed NEPA, the National Environmental Protection Act. This act added the role to the United States to be "the protector of earth, air, land, and water" (Farrah, 1992, September 6, An Environmental Revolution, para. 2). Under NEPA, President Nixon was to assemble a Council on Environmental Quality from the Cabinet that would gather data, advise on policy, and prepare annual environmental quality reports. Nixon signed the act on January 1, 1970. On February 10, he spoke to the House and Senate on the improvement of water treatment facilities, national air quality standards, guidelines for lowering vehicle emissions, cleaning federal facilities that were contaminating air and water, ending waste dumping into the Great Lakes, taxing lead additives in gasoline, safer transportation of oil, and a plan for treating oil spills.

On July 9, Nixon stated his objective of creating the United States Environmental Protection Agency (US EPA). The EPA passed through all regulating bodies and was created on December 2, 1970 (Farrah, 1992, September 6). The NAAQS were created under the Clean Air Act of 1970 and thus placed under the implementation of the EPA. Today, two sets of amendments, Clean Air Act Amendments of 1977 and 1990, have been added (United States Environmental Protection Agency, 2016). NAAQS evaluates six main air pollutants that are measured by the EPA, which are dubbed as the criteria air pollutants.

Criteria Air Pollutants

The criteria air pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter of diameter of 2.5 microns or less ($PM_{2.5}$), particulate matter of diameter of 10 microns or less (PM_{10}), and sulfur dioxide (SO_2). The contaminants are measured by parts per million (ppm), parts per billion (ppb), or micrograms per cubic meter ($\mu g/m^3$). Furthermore, there are two sets of standards: "Primary standards provide public health protection including protection the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings" (United States Environmental Protection Agency, 2016, NAAQS Table, para. 1). The current NAAQS Table of Criteria Air Pollutants can be seen in Table 1. In addition to the aforementioned air contaminants being required to abide to the NAAQS, there are many benefits to reduced levels of their presence. The contaminants regulated by the EPA can have significant detrimental health effects. By reducing the levels of contamination, people, especially sensitive groups, have better health which leads to fewer medical expenses for the person and their employer. Lower levels are important in the indoor environment because this is where the majority of people spend a large portion of the day. Low levels of pollution are important for the outdoor environment to reduce smog, promote healthier flora and fauna, and to ensure the health of those who work mostly in the outdoors. Additionally, the side effects of several of the regulated contaminants are drowsiness or difficulty concentrating. By improving the air quality, people are also able to be more productive and enjoy their working and living environments more (Kats, 2003).

Carbon monoxide. The first pollutant addressed by the NAAQS Table of Criteria Air Contaminants is carbon monoxide. Carbon monoxide is a colorless, tasteless, and odorless gas

Table 1

NAAQS Table of Criteria Air Pollutants

Pollutant		Primary/Secondary	Averaging Time	Level		Form
Name	Abbr.			Number	Unit	
Carbon Monoxide	CO	Primary	8 hours	9	ppm	Not to be exceeded more than once per year
			1 hour	35	ppm	
Lead	Pb	Primary and Secondary	Rolling 3 month average	0.15	μg/m³ [1]	Not to be exceeded
Nitrogen Dioxide	NO_2	Primary	1 hour	100	ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	1 year	53	ppb [2]	Annual mean
Ozone	O_3	Primary and Secondary	8 hours	0.070	ppm [3]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	Primary	1 year	12.0	μg/m³	Annual mean, averaged over 3 years
		Secondary	1 year	15.0	μg/m³	Annual mean, averaged over 3 years
		Primary and Secondary	24 hours	35	μg/m³	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24 hours	150	μg/m³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide	SO_2	Primary	1 hour	75	ppb [4]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5	ppm	Not to be exceeded more than once per year

[1] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

[2] The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[3] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

[4] The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Note. The current, as of 2016, NAAQS Table of Criteria Air Pollutants, from the Clean Air Act of 1970, Clean Air Act Amendments of 1977, and Clean Air Act Amendments of 1990. Adapted from "NAAQS Table" by the United States Environmental Protections Agency, 20 December, 2016. Retrieved from https://www.epa.gov/criteria-air-pollutants/naaqs-table.

that is created due to incomplete combustion. It is more commonly found in higher levels indoor than outdoors.

Health effects. Carbon monoxide restricts the body's ability to transport oxygen through the body, most notably to the heart and the brain. The oxygen carried through the blood stream is replaced with carbon monoxide, and the organs and tissues seeking oxygen absorb this gas instead. This suffocates a person from the inside (Safe I.S. Ltd., 2016; Greiner, 1997, April). Carbon monoxide poisoning is the leading cause of poisoning-related deaths in the United States (Greiner, 1997, April).

Carbon monoxide poisoning is often misdiagnosed as the flu or food poisoning. Common side effects include headaches, nausea, dizziness, confusion, weakness, drowsiness, and difficulties breathing. In acute cases, there may be convulsions, coma, or death. Over prolonged periods, the symptoms may expand to include worsening heart conditions, mental deterioration, incontinence, personality changes, depression, amnesia, and impaired vision and coordination. Children are at higher risk than adults, as children have higher breathing rates, are less physically developed, and have higher metabolic rates than adults (Safe I.S. Ltd., 2016; Greiner, 1997, April).

Sources. There are several common sources of carbon monoxide. Any process that results in incomplete combustion may produce carbon monoxide; any fire that burns a carbon-based product may generate this. This includes stoves, lanterns, candles, incense, and space heaters in indoor spaces. Outdoors, vehicular exhaust is the largest source, but also accompanied by generators, fires, grilles, and cigarettes (Greiner, 1997, April).

Measurements. Carbon monoxide is measured by an infrared meter or electrochemical meter. The infrared meter, refer to Figure 1, consists of two cells. One cell is sealed and contains only the reference gas. The other cell, parallel to the first, filters the air to be sampled through it. At one end of the cells is a source that emits infrared light rays. The rays are directed

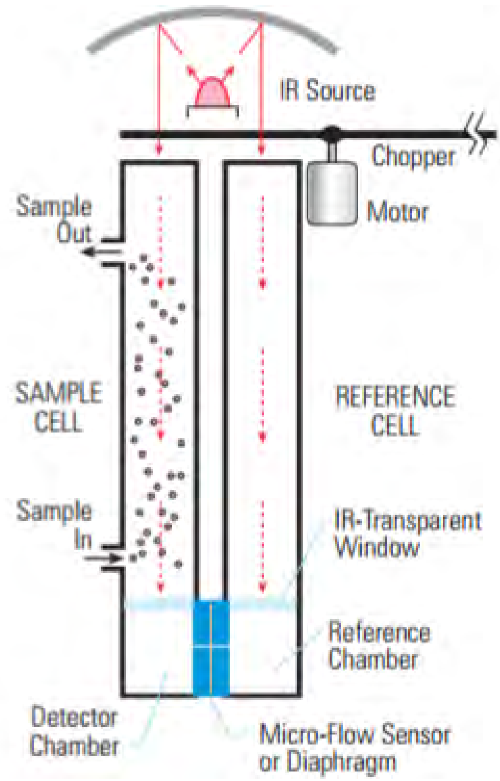

Figure 1. Diagram of an infrared meter as used in measuring carbon monoxide. Adapted from: *Hazardous Gas Monitors: A Practical Guide to Selection, Operation and Applications,* by J. Chou, 2000, New York: McGraw-Hill, p. 60.

into the cells. At the opposite end of each cell is a reference chamber and detector chamber, respectively. The diaphragm between the two chambers can measure the difference in capacitance. This value can then be used to determine the type and amount of gas (Chou, 2000). The second meter type is the electrochemical meter, refer to Figure 2. The main components of the meter are an ion conductor between a working electrode and a counter electrode. When a gas contacts the working electrode, it reacts with air entrained water molecules, and causing oxidation of the gas. Oxidation causes electrons to loosen, which then are transferred through the ammeter to the other side, the counter electrode side, of the ion conductor. The hydrogen ions are attracted to the more negative side of the ion conductor, and thus flow toward that side. Here, hydrogen ions react with oxygen in the air to produce water molecules. The concentration

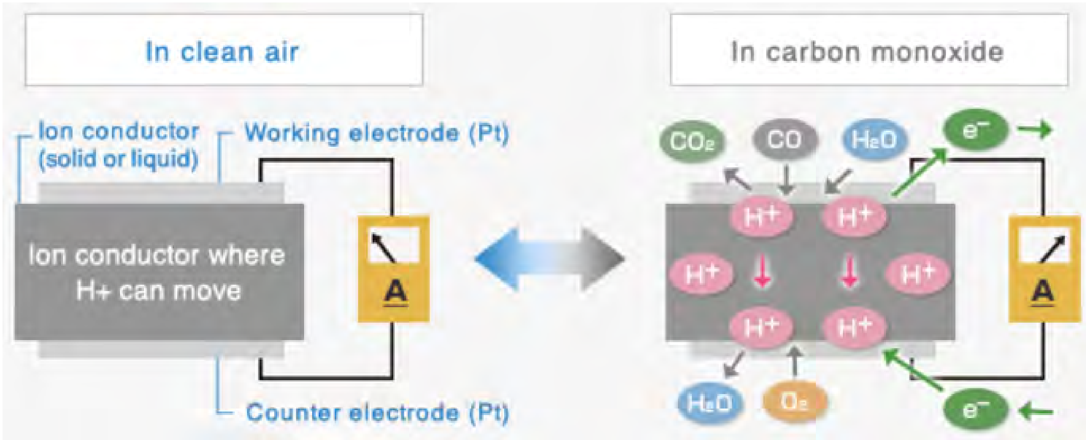

Figure 2. Diagram of an electrochemical meter as used in measuring carbon monoxide. Adapted from *Operating Type: Electrochemical Type* by FIGARO Engineering Inc. (n.d.), para. 1. Retrieved from http://www.figaro.co.jp/en/technicalinfo/principle/electrochemical-type.html.

of gas can be found by the current between the working electrode and the counter electrode (FIGARO Engineering Inc., n.d.). The meter used in this study utilizes the infrared method of measuring.

Prevention and remediation. Carbon monoxide generation can be prevented and remediated in a few ways. Because carbon monoxide is created through incomplete combustion, carbon monoxide can be prevented by using energy or heat source that do not require combustion, such as solar or geothermal heating in buildings and electric cars. When that is not possible, it is important that the combustion process is as efficient as practically possible, adequate oxygen is provided to the flame, an adequate temperature is maintained for combustion, and that the equipment meets all required licenses and permits. To remediate carbon monoxide build up, well routed and plentiful ventilation is vitally important. If ductwork is used, for example, for the flue gases of boilers, it is essential that the ductwork has minimal leakage, is kept far from outside air intakes, and can exhaust the volumes of air necessary to flush out carbon monoxide. In a home or a system that does not use direct exhaust measures, there should be ample amounts of air provided through the space to adequately ventilate, and therefore dissipate, carbon monoxide (Greiner, 1997, April).

Lead. The second contaminant addressed by NAAQS is lead. Lead is a naturally occurring heavy metal in the earth's crust; however, it is neither beneficial nor naturally occurring in the human body (Mayo Clinic Staff, 2014, June 10). Pure lead is a bluish-white malleable material that quickly tarnishes to gray when in contact with air. In the United States, lead was once commonly found indoors and outdoors. The widespread use of lead has been banned in the United States. This study does not address lead due to the sampling method. However, for continuity of explaining the Criteria Air Pollutants, lead will be covered in the background discussion.

Health effects. This metal is absorbed through inhalation or ingestion, and is not absorbed through the skin. Lead, from the point of view of the body, mimics the actions of calcium and is also able to interact with the body's proteins. This allows lead to be deposited in a variety of places, such as the bones, organs, and tissues, throughout the body (Agency for Toxic Substances and Disease Registry, 2012;W.W. Grainger, Inc., 2015, July). Lead poisoning is especially detrimental to children, as they are still developing and can be more easily negatively affected long-term. There also "may be no threshold for developmental effects on children" (Agency for Toxic Substances and Disease Registry, 2012, para. 3). For children, prolonged effects of low dose and long exposure are lowered IQs, attention deficit hyperactivity disorder (ADHD), hearing impairments, and poor balance. In acute exposures, children may experience changes in brain development, lack of muscle coordination, stupor, extreme irritability, coma, convulsions, and death. In severe cases of child lead poisoning, there may be bone malformation due to lack of calcium and vitamin D. Non-fatal symptoms that are developed during childhood may continue into adulthood.

In addition to neurological symptoms experienced in children, symptoms in adults may include depression, headaches, impaired motor skills, dizziness, fatigue, forgetfulness, weakness, or paresthesia. Other conditions include kidney diseases, renal diseases, gout, changes in blood composition, anemia, severe abdominal cramps, hypertension and related heart diseases, reduced fertility, and non-optimal births (W.W. Grainger, Inc., 2015, July).

Sources. Lead was once widely used due to the ability of lead to economically improve items. The use of lead has been severely restricted in most developed countries due to the extreme negative effects. However, lead may still be used in undeveloped countries, or has been grandfathered-in, where already existing, in developed countries and noted to be removed at a later date. Sources of possible lead contamination are gasoline, paints, soil, pipes, water, and some imported products. Air contamination is due to the burning of fossil fuels or paints. Lead is naturally occurring in soil, but fallen lead particles from the burning of fossil fuels and paints, and seepage from pipes may have further polluted the soil. Water transported by lead pipes also tends to suffer from lead contamination. Both soil and water are used to grow plants, and therefore may produce contaminated produce. Imported products, especially painted or iron-based products from undeveloped countries may also be contaminated with lead due to lack of regulation or knowledge (Environmental Protection Authority, 2016, May).

Measurements. Lead is measured in a variety of manners, each specific to the type media being tested. Air is sampled with an air pump and membrane filter, as seen in Figure 3. The pump pulls through a predetermined volumetric flow rate of air over a given time through the filter. As air is pulled through the filter, contaminants build up on the surface. The filter is

Figure 3. Air pump with cassette as used in sampling lead entrained in air. Adapted from "Detectors" by AFC International, Inc., n.d., para. 1. Retrieved from http://www.afcintl.com/diaphragm-area-sampling-pmp-1.aspx.

then sent into a laboratory where the particles are identified by weight and structure. For all lead sampling, the sample needs to be sent into a lab. Soil samples are small amounts of soil captured in sealable tubes. Surface samples are fibrous wipes or swabs that are swept across the surface in question. Water samples are collected in a sealable container (W.W. Grainger, Inc., 2015, July).

Prevention and remediation. Many actions have been taken to reduce and remediate lead levels in the United States. Because such major government preventions and remediation have already begun, there is a significantly reduced ability to purchase lead based items. If one has already come into dermal contact with lead, it recommended to replace their outfit with clean clothes and shower as to avoid accidental ingestion or inhalation. Additionally, if lead is suspected, drinking or working in lead contaminated areas should be avoided. In homes and business, lead abatement is an option for professional removal of lead paints, pipes, etc. (W.W. Grainger, Inc., 2015, July; Environmental Protection Authority, 2016, May).

Nitrogen dioxide. Nitrogen dioxide is a reddish-brown gas. This toxic pollutant is water-insoluble, has a strong and irritating odor, is a highly reactive oxidant, and is corrosive (The University of Kansas, n.d.; New Jersey Department of Health and Senior Services, 2000, April; United States Environmental Protection Agency, 2016, March 23). This gas is commonly found both indoors and outdoors, but is typically in higher levels outdoors.

Health effects. Nitrogen dioxide does not readily react to the mucous membranes because it is water-insoluble. However, in acute cases, if the nitrogen dioxide does react with water, most notably in the eyes, nitric acid will slowly form and may cause redness, pain, and severe burns. Dermal exposure also may result in irritation, redness, pain, and burns (The University of Kansas Hospital, n.d.). Inhalation may result in coughing, shortness of breath, pulmonary edema, headache, fatigue, dizziness, blue dermal discoloration (The University of Kansas, n.d.; New Jersey Department of Health and Senior Services, 2000, April). Additionally, because nitrogen dioxide is fairly water-insoluble, the toxic gas can begin blocking the gas exchange process in the lungs without eye, nose, or throat irritation, and effectively cause death with few signs. Symptoms due to acute exposure to nitrogen dioxide may be delayed up to 30 hours (The University of Kansas, n.d.). Once recovered from the acute exposure, one may suffer effects shared with long term exposure after about two to six weeks. Long term exposure may lead to permanent lung damage, carcinogenic mutations, and increased risk of respiratory infections (The University of Kansas, n.d.; New Jersey Department of Health and Senior Services, 2000, April; United States Environmental Protection Agency, 2016, March 23).

Sources. Many of the sources of nitrogen dioxide are from processes requiring high levels of heat. Indoors, space heaters and gas stoves are most applicable to the common person (American Lung Association, 2016). Industrial spaces are at higher risk, as the following indoor practices of nitric and sulfuric acid production, boiler plant use, metal finishing operations, welding, handling of rocket fuel oxidizers, and the manufacturing of explosives, plastics, glass, dyes, etc. are more prevalent. Fires, grain storage, tobacco smoke, and emissions from personal and public vehicles, heavy construction equipment, and power plants are large contributors to the outdoor concentration of nitrogen dioxide (The University of Kansas Hospital, n.d.; American Lung Association, 2016; USP Technologies, 2016).

Measurements. The main way of measuring nitrogen dioxide is through chemiluminescence. Chemiluminescence is the emission of light due to a chemical reaction. The amount of total nitrogen oxides (NO_x) in the air is measured. Then air is drawn into the reaction chamber where nitrogen monoxide (NO) reacts with the ozone. The resulting reaction emits light and nitrogen dioxide. The amount of light emitted determines the amount of nitrogen monoxide in the air. Nitrogen dioxide is then calculated by subtracting the value of nitrogen monoxide from the total amount of nitrogen oxides. Refer to Figure 4 for a visual description. Another common method of calculating nitrogen dioxide is through an electrochemical meter. Please refer to the meterdescription of carbon monoxide below Figure 2. The meter used in this study utilizes the chemiluminescence method of measuring the level of contamination.

Prevention and remediation. Nitrogen Dioxide formation can be reduced by substituting nitrogen dioxide for a less toxic chemical in industrial processes, reducing energy consumption, and reducing fossil fuel consumption. Harmful exposure can be reduced by isolating nitrogen dioxide producing procedures, using well-installed and sized local ventilation, using respirators and other protective articles of clothing, and ensuring proper installation, operation, and maintenance of appliances and processes (New Jersey Department of Health and

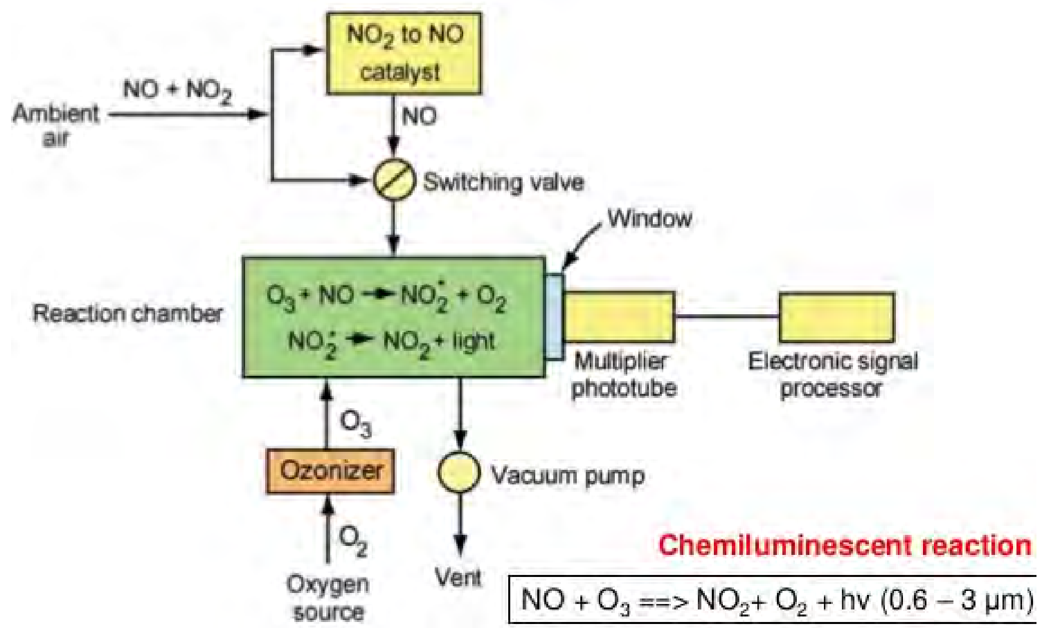

Figure 4. Diagram of a chemiluminescent reaction used to determine the amount of nitrogen dioxide in the air. Adapted from: "Air Quality Sampling and Monitoring", (Powerpoint presentation) by B. Mohanty, 1 February 2013, Slide 40. Retrieved from http://www.slideshare.net/bibhabasumohanty/air-quality-sampling-and-monitoring-m5.

Senior Services, 2000, April; United States Environmental Protection Agency, 2016, March 23). Nitrogen oxides may be remediated through a gas scrubbing treatment. Sodium hydroxide and hydrogen peroxide are the two mains scrubbing solutions. Sodium hydroxide is the conventional solution, however hydrogen peroxide has more beneficial and fewer harmful products than sodium hydroxide (USP Technologies, 2016).

Ozone. Ozone is a highly reactive, colorless or slightly blue, and pungent gas that creates a type of barrier to other gases and ultraviolet light. Ozone is typically classified as good or bad, which can be visualized in Figure 5. Good ozone occurs in the stratosphere, approximately ten to thirty miles above Earth's surface. Here the layer created by the ozone protects Earth from the harmful ultraviolet (UV) rays emitted from the sun. However, bad ozone, typically caught in the

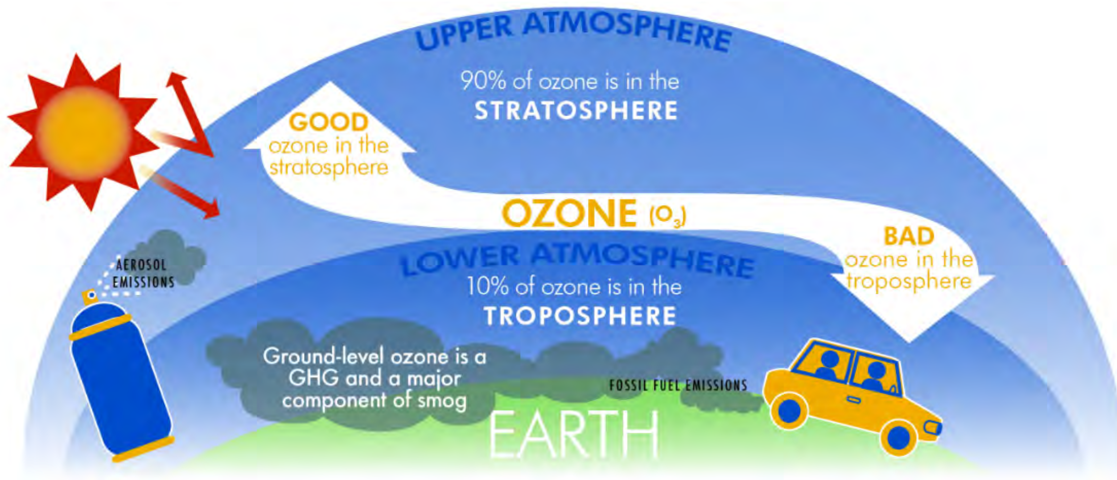

Figure 5. Graphic of the location of good and bad ozone in the atmosphere. Adapted from "Let's Learn with Fun: Can the Ozone Hole be Repaired", n.d., para. 3. Retrieved from https://letslearnwithfun.wordpress.com/2015/08/10/can-the-ozone-hole-be-repaired.

troposphere, also creates a barrier trapping in other toxic substances in its reaction with ultraviolet light. Thus, this toxic gas is a large contributor and magnifier of smog. Ozone is almost exclusively found in the outdoor environment (Department of Environmental Quality, 2016; US EPA Office of Air and Radiation, 2009, February).

Health effects. Ozone is most commonly inhaled. Symptoms due to acute exposure to ozone include irritation of the mucous membranes, difficulty breathing, shallowness of breath, inflamed lungs, aggravation of asthma and other chronic lung diseases, and increased risk of respiratory infection. Long term exposure may lead to chronic inflammation and scarring of the lungs, and premature death. Chronic damages may also occur with no symptoms. Increased levels of ozone pollution also reduce crop and forest yields, and reduce disease and pest resistance in affected vegetation (Department of Environmental Quality, 2016; US EPA Office of Air and Radiation, 2009, February).

Sources. Generally, ozone is not directly produced; it is a side-effect of increased levels of nitrogen oxides and volatile organic compounds (VOCs). Ultraviolet radiation initiates a photolytic reaction between the nitrogen oxides and the VOCs. Hot summer months produce larger amounts of UV radiation; therefore, ozone levels are typically increased in summer. Due to the necessity of UV light and the reactivity of the gas, ozone is not commonly found indoors. High ozone concentrations can be found outside of idyllic creation environments due to wind currents (Department of Environmental Quality, 2016). Ozone found indoors typically originates from outside, but may have formed from a photocopier, or from leaks in specialty equipment used to clean air or water.

Measurements. One of the primary methods of measuring levels of ozone is by ultraviolet photometry. Because ozone is known to absorb UV light at a wavelength of 254 nm, this length can be selected through the wavelength selector in the photometer. The light rays at this wavelength are projected through a sample containing ozone. Rays not absorbed by the ozone are measured by the detector (Georgia Institute of Technology, 2008). Please refer to Figure 6. Another common method of calculating ozone is through an electrochemical meter. Please refer to Figure 2. The meter used in this study utilizes the UV photometric method of measuring the level of contamination.

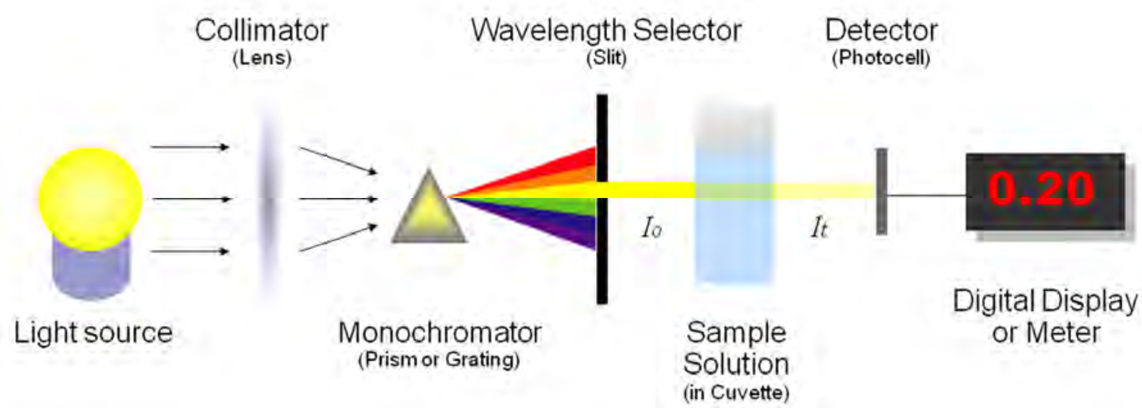

Figure 6. Diagram of the photometric process as used to measure general solutions, including ozone.
Adapted from "Biochemistry Class Notes" by P.R. Shakya, 2013, "Colorimeter" para. 2. Retrieved from http://edusanjalbiochemist.blogspot.com/2015/12/photometry-principle-applications-and.html.

Prevention and remediation. Because ozone is a secondary pollutant, the most effective method of prevention is to reduce levels of air pollutants that result in smog, namely nitrogen oxides and VOCs. Where ozone is produced, such as in water purification processes, ozone can be prevented by ensuring that equipment is properly installed, operated, and maintained. As of now there are no means of remediation, as any action against tropospheric ozone may negatively affect stratospheric ozone levels.

Particulate matter. Particulate matter (PM) is a solid particle or liquid droplet suspended in the air, such as dust, dirt, soot, smoke, sulfates, nitrates, allergens, microbial compounds, etc. Particulate matter is commonly divided into two categories: particulate matter of diameter of 2.5 microns or less ($PM_{2.5}$), and particulate matter of diameter of 10 microns or less (PM_{10}) (United States Environmental Protection Agency, 2016, September 12; World Health Organization, 2013). For visual reference, please see Figure 7.

Health effects. Particulate matter is most commonly inhaled. Acute and long term human health effects of particulate matter are similar. They include irritated airways, coughing, difficulty breathing, decreased lung function, aggravated asthma, irregular heartbeat, nonfatal heart attacks, and premature death. PM_{10} and below can enter the lungs and the bloodstream. However, because $PM_{2.5}$ is smaller and lighter than PM_{10}, it takes longer to settle out of the air and is more easily able to penetrate further into the respiratory and cardiovascular system. In addition to human health, particulate matter is detrimental to environmental health. $PM_{2.5}$ is the main cause of haze (United States Environmental Protection Agency, 2016, September12; United States Environmental Protection Agency, 2016, July 1). Particulate matter can be carried great distances by wind resulting in acidification of lakes, streams, and rain; "changing the nutrient balance in coastal waters and large river basins, depleting the nutrients in soil, damaging

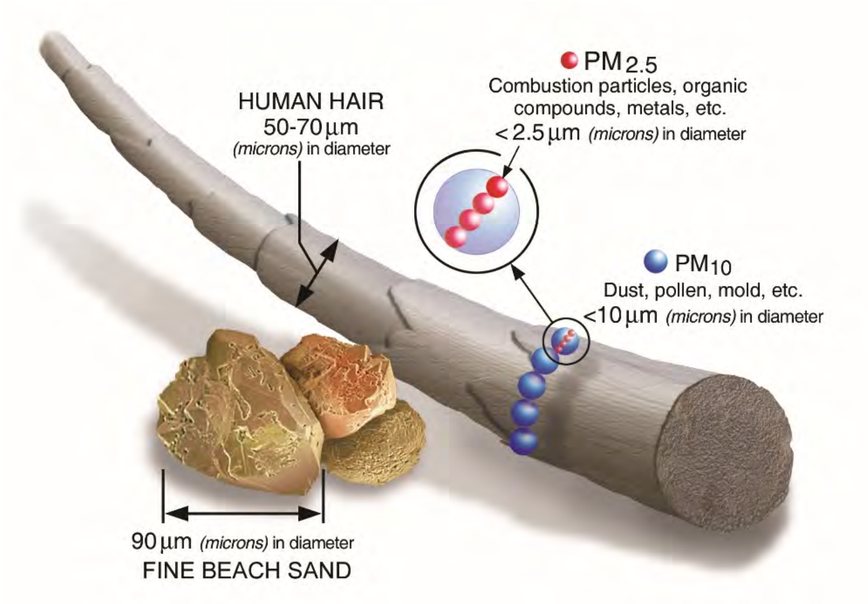

Figure 7. Visual reference for the size of $PM_{2.5}$ and PM_{10}. Adopted from *Particulate Matter (PM) Pollution: Particulate Matter (PM) Basics,* by the United States Environmental Protection Agency, 2016, September 12, para. 1. Retrieved from United States Environmental Protection Agency: https://www.epa.gov/pm-pollution/particulate-matter-pm-basic#effects.

sensitive forests and farm crops, and affecting the diversity of ecosystems" (United States Environmental Protection Agency, 2016, July 1, "Environmental Effects: Environmental Damage", para. 1).

Sources. Particulate matters results from man-made and natural sources. Primary man-made sources include fuel combustion; erosion of pavement and structures; industrial processes such as mining, construction, manufacturing, ceramic making, and smelting; agriculture; smokestacks; and fire. Particulate matter can also occur as the result of a series of chemical reactions stemming from sulfur dioxide, nitrogen oxides, ammonia, and non-methane VOCs. These pollutants are commonly emitted from power plants, industrial facilities, and vehicles. Lack of water increases probability of soil and dust re-entrainment into the air. Natural sources include soil and rock erosion, acts of God, and fire (United States Environmental Protection Agency, 2016, September12; United States Environmental Protection Agency, 2016, July 1).

Measurements. Two common methods of measuring particulate matter are inertial separation (gravimetric) analysis and light scattering analysis. In gravimetric analysis, the amount of particulate matter calculated by a weight differential from before and after the sampling period. Different sizes of particulate matter can be evaluated by using different filters. An unused filter is acquired, either from a lab or independent source. The sample is collected by an air pump running at a designated volumetric flow rate for a set period of time. The sample is then sent into a lab for analysis. Please refer to Figure 3. In light scattering analysis, particulate matter levels are established through particle size and scattering of the wavelengths. Beams of laser light are scattered to various directions. By measuring the amount of light received by detectors in different locations relative to the original set of the laser beam, the values can be used to determine the size and concentration of the particulate matter (Amaral, de Carvalho, Jr., Costa, & Pinheiro, 2015, September 9). Please see Figure 8 for visual reference. The meter used in this study utilizes the laser scattering method of measuring the level of contamination.

Prevention and remediation. Particulate matter levels can be lowered by reducing fuel consumption, reducing energy consumption, using less disruptive or wasteful industrial processes, reducing fires, and reducing the level on contaminants that cause secondary particulate pollution. PM levels can be reduced indoors with air filters, vestibules, and door mats. Filters are used in all mechanically ventilated systems and are classified by their Minimum Efficiency Ratio Value (MERV), where MERV 1 filters are the least efficient in removing particulate matter and MERV 20 filters are the most efficient at removing particulate matter from the air.

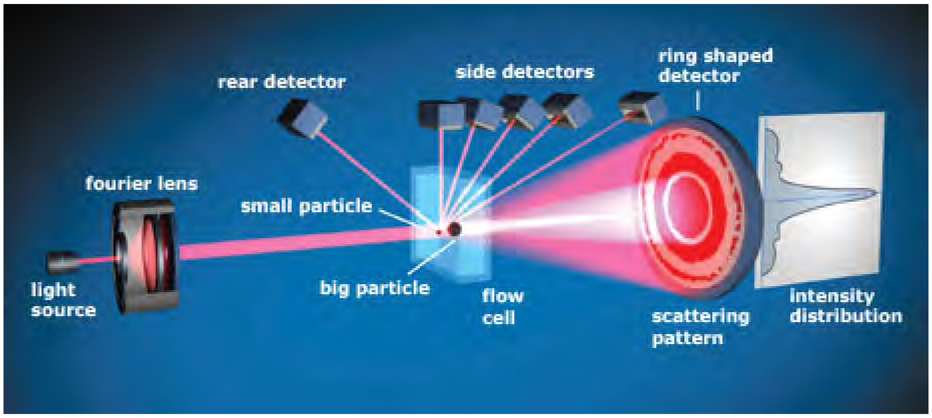

Figure 8. Diagram of a light scattering photometer as used in sampling particulate matter. Adapted from "Static Laser Light Scattering" by Retsch Technology, 2017, para. 5. Retrieved from http://www.retsch-technology.com/applications/technical-basics/static-laser-light-scattering/.

Sulfur dioxide. Sulfur dioxide is a colorless, pungent, corrosive, and toxic gas that is easily water-soluble (Canadian Centre for Occupational Health and Safety, 2013, February 13; Australian Department of the Environment and Heritage, 2005). This gas can be found indoors and outdoors.

Health effects. Sulfur dioxide can harm human health through inhalation and dermal contact. Sulfur dioxide can also enter the bloodstream through the lungs. In acute exposures, sulfur dioxide may cause coughing, shortness of breath, difficulty breathing, tightness in the chest, asthma, increased respiratory sensitivity, corrosion and scarring of the respiratory tract, pulmonary edema, possible genetic defects, and fatality. Symptoms of acute exposure are typically felt within ten to fifteen minutes of inhalation. Due to the corrosive nature of sulfur dioxide, dermal exposure may lead to severe skin and eyes burns, leading to permanent damage such as scarring and blindness. In addition to the chronic effect of acute exposure, long term exposure may also lead to irritable and inflamed airways, respiratory harm, and may cause genetic damage (Canadian Centre for Occupational Health and Safety, 2013, February 13;

Australian Department of the Environment and Heritage, 2005; Agency for Toxic Substances and Disease Registry, 1998, December).

Sources. The Australian Government's Department of Environment and Heritage states that "about 99% of the sulfur dioxide in air comes from human sources" (2005, "What Is Sulfur Dioxide?", para. 2). Such human sources include industrial activities such as mining, electricity generation, and the burning of fossil fuels (Australian Department of the Environment and Heritage, 2005). The 1% of sulfur dioxide originating from natural sources are emitted by volcanoes, geysers, and similar entities. Once in the air, sulfur dioxide can form sulfuric acid, sulfur trioxide, and sulfates. The gas can easily dissolve into water or be absorbed by soil (Agency for Toxic Substances and Disease Registry, 1998, December).

Measurements. Two common methods of measuring sulfur dioxide are via ultraviolet fluorescence or ultraviolet photometry. UV fluorescence calculates the concentration of sulfur dioxide "by measuring the fluorescent radiation energy produced when the sulphur dioxide molecules are bombarded by UV radiation inside the analyzer" (Sheffield City Council, 2017, "How Is Sulphur Dioxide (SO_2) Measured?, para. 1). Please see Figure 9 for a visual reference. The second method of determining sulfur dioxide levels is through UV photometry. Please refer to description under ozone in Section 1.2.4.3 and Figure 6. The optimal to decaying wavelengths for sulfur is 214 to 300 nm, respectively (United States Environmental Protection Agency, 2004, October 14). The meter used in this study utilizes the UV fluorescence method of measuring the level of contamination.

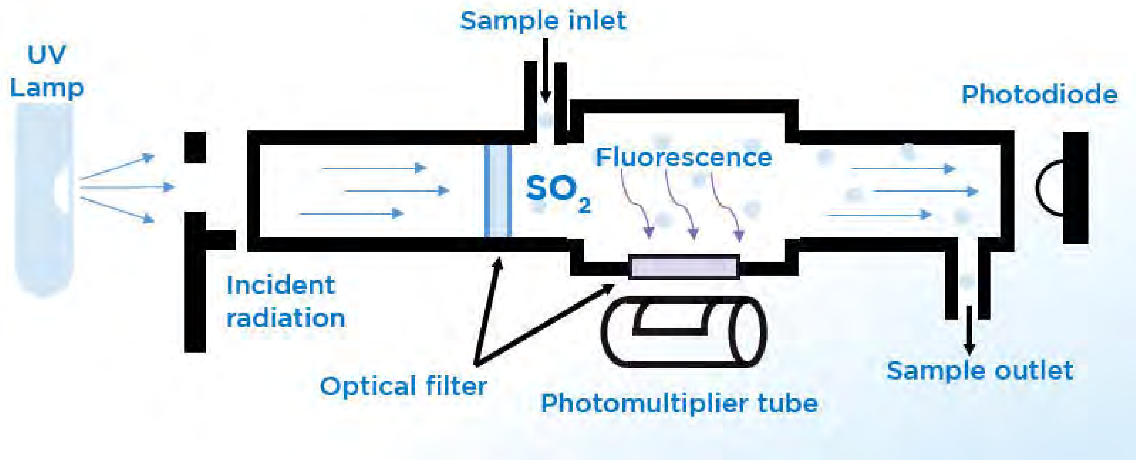

Figure 9. Diagram of an utraviolet flurosecent meter as used in sampling sulfur dioxide. Adapted from "Sulfur Dioxide Analyzer/Sulfur/Concentration/Benchtop E-Serie – AF22E" by Environment S.A., 2017, para.1. Retrieved from http://www.directindustry.com/prod/environnement-sa/product-23554-1790321.html

Prevention and remediation. The levels of sulfur dioxide can be reduced by consuming less electricity, using fewer amounts of fossil fuels, and reducing industrial activities that result in the sulfur dioxide emissions.

Other Air Parameters

Carbon dioxide. Carbon dioxide (CO_2) is not regulated by the NAAQS. However, the level of carbon dioxide is important to note as high levels of carbon dioxide may be indicative of high levels of more harmful contaminants. The most common health effect of carbon dioxide is drowsiness and lack of concentration. Carbon dioxide is a natural emission due to breathing, fire, controlled combustion processes such vehicular exhaust and electricity generation, and industrial processes such as cement and steel production. Indoors, high levels of carbon dioxide may be due to lack of proper ventilation or malfunctioning equipment. Carbon dioxide is the most common greenhouse gas (GHG), and accounts for approximately 81% of US GHG emissions. Outdoor carbon dioxide levels are complicated through the reduction of carbon sinks, such as forests and lakes, due to deforestation and malpractices in agriculture. Carbon dioxide is most commonly measured by an infrared meter. Please refer to Figure 1. Carbon dioxide can be prevented or reduced by improving industrial processes, discontinuing burning fossil fuels, and many other ways. Carbon dioxide levels can be remediated by sustainable foresting programs, reducing pollution into bodies of water, and properly caring for the earth. It should be noted that carbon dioxide, in moderation, is essential and becomes dangerous once it passes moderation into extravagant quantities.

Ambient air temperature. Ambient air temperature (TA) is the temperature read by a common thermometer or thermostat. Ambient air temperature can also be referred to as dry bulb temperature (DB).

Dew point temperature. Dew point temperature (DP) is the temperature at which, given the same pressure and air moisture content, condensation begins to form.

Wet bulb temperature. Wet bulb temperature (WB)

> is measured by a thermometer with a wetted bulb rotated rapidly in the air to cause evaporation of its moisture…. In dry air the moisture readily evaporates and draws heat out of the thermometer to produce a lower temperature reading. (Haines & Hittle, 2006, p. 288)

For a given ambient air temperature, air with lower level humidity will result in a lower wet bulb temperature and air with a higher relative humidity will result in a higher wet bulb temperature. Also, at full saturation, ambient air temperature, dew point temperature, and wet bulb temperature will be equal.

Relative humidity. Relative humidity (RH) can be measured directly or calculated from the ambient air temperature and wet bulb temperature. Relative humidity “is the ratio of the actual density of water vapor in air to the maximum density of water vapor that such air could contain, at the same temperature, if it were 100% saturated" (Grondzik & Kwok, 2015, p.188)

Other noted parameters. For this study, outside weather conditions, such as cloud coverage and precipitation, were only broadly recorded based on sensory observations. Atypical activities, such as temporary construction at nearby locations or days when sampling occurred during janitorial rounds, were also broadly recorded based on sensory observations.

Literature Review

Outdoor air pollution in the United States is regulated according to the EPA's NAAQS. While outdoor air quality is important, the average person spends only about 10% of their time outdoors while the remaining 90% is spent indoors (European Collaborative Action: Urban Air, Indoor Environment and Human Exposure Working Group 16, 2003). "However, there is a clear lack of precise and scientifically well argued [sic] target values in relation to the air pollution levels and, therefore also of the ventilation levels" (European Collaborative Action: Urban Air, Indoor Environment and Human Exposure Working Group 16, 2003, p. 7). Because of the large amount of time spent indoors, the removal of indoor air contaminants through ventilation is crucial. Indoor pollutants are typically flushed out by bringing in outside air and relieving an equal amount of polluted air to the outside, either through mechanical ventilation or natural ventilation. While the mechanical equipment, such as air handling units (AHUs) and roof top units (RTUs), have varying filters to clean the outside air as it enters the building and is recirculated, which naturally ventilated buildings may not have, outdoor air pollution levels may affect indoor air pollution levels (European Collaborative Action: Urban Air, Indoor

Environment and Human Exposure Working Group 16, 2003). Chen and Zhao (2011) explain the general relationship between indoor and outdoor air particulate levels in Equation (1):

$$C_{in} = F_{in}C_{out} + C_{\dot{s}} \quad (1)$$

where:

C_{in}=Indoor Particle Concentration,

F_{in}=Infiltration Factor,

C_{out}=Outdoor Particle Concentration, and

$C_{\dot{s}}$=Indoor Particle Emission Rate.

The indoor and outdoor particle concentrations can be measured with equipment. The infiltration factor accounts for the fractional amount of "ambient particles that penetrates indoors and remains suspended" (Chen & Zhao, 2011, p. 275). Thus the infiltration factor describes the portion of the contaminant that can pass through the mechanical equipment filtration system, cracks and openings in the building envelope, open windows or doors, etc. The indoor particle emission rate is generated through indoor sources (Chen & Zhao, 2011).

Equation (1) can be manipulated into several forms by making assumptions or expanding the already existent terms. Additionally, Equation (1) can be used to represent the relationship between indoor and outdoor contaminant levels in both mechanically and naturally ventilated buildings. The infiltration factor will be greatly affected by the filter efficiency and filter type in the mechanically ventilated system, whereas infiltration factor would not account for this in the naturally ventilated system (Chen & Zhao, 2011).

The coefficient for Equation (1) can be found through a series of indoor and outdoor particulate measurements, because Equation (1) follows the easily graphed equation of a straight line:

$$y = mx + b. \tag{2}$$

Relating Equation (1) with Equation (2), Equation (1) can be graphed as: the indoor concentration as the y-value, the infiltration factor as the slope, the outdoor concentration as the x-value, and the indoor contaminant source as the y-intercept (Chen & Zhao, 2011).

The relationship between indoor and outdoor contaminant levels is also often shown as a ratio. Chen and Zhao show the ratio, typically referred to as the I/O ratio, as:

$$I/O \text{ ratio} = \frac{C_{in}}{C_{out}}. \tag{3}$$

Similar to Equation (1), Equation (3) can be manipulated in various forms. Most commonly, the I/O ratio is determined so that it can be referenced against a factor that may influence the ratio. In Chen and Zhao's review of relationship of indoor and outdoor particles, they found that there was no "uniform conclusion of the impact of particle size on I/O ratio" and that "the I/O relation is not useful in understanding indoor/outdoor particle relationships" (Chen & Zhao, 2011, pp. 278-9), citing that general information and varying measurement conditions as the most likely culprits for the inconsistency (Chen & Zhao, 2011).

While there are innumerable factors that may cause the variants in measurement conditions for all contaminant levels, there are studies that have determined either a strong or weak correlation between some of these relationships. Generally for all contaminants, it has been shown that smoking is one of the most polluting activities of indoor air (Monn, 2001; (Challoner & Gill, 2014). Additionally, green building construction typically has poorer air quality than standard building construction because of energy efficiency measures such as a tighter building envelope and reduced outside air flow volume change rates (Anggabrata & Wong, 2013). Other studies have shown, either through the I/O ratio or comparing indoor and outdoor contaminant levels, specific factors affecting either the relationship between the levels, or the levels of contaminants. Particulate matter, denoted as $PM_{2.5}$, PM_{10}, Total Suspended Particulates (TSP), or Respirable Suspended Particulates (RSP), is affected by several defined factors. The filter efficiency of mechanically ventilated buildings prevents particulate matter from entering the indoor airstream from the outdoors (Chen & Zhao, 2011; Hassenvand et. al., 2014; Chan, 2002). The deposition rate being driven by different forces for different particles sizes as Brownian diffusion is important for ultrafine particles, and gravity is important for coarse particles (Chen & Zhao, 2011). As distance from vehicular traffic increases, particulate matter generally decreases, but has also shown to be statistically neutral (Monn, 2001). Particulate levels are greatest near street level and dissipate as elevation increases. However, it should be noted that due to complex local air events in cities may disrupt this (Monn, 2001). As temperature increases, the I/O ratio increases. As humidity increases, the outdoor levels of particulate matter decrease (Challoner & Gill, 2014).

Monn (2001) and Challoner and Gill (2014) also showed a similar relationship factors for NO_2. The similar factors include distance from vehicular traffic, elevation, temperature, and humidity. Additionally, diurnal variations showed that NO_2 was higher during the day and lower at night, especially during rush hour periods (Challoner & Gill, 2014). O_3 was determined to have the highest levels at the end of daylight hours and during spring and summer (Monn, 2001). Several studies also concluded to little or no ozone being present indoors (Monn, 2001; Yocom, 1982, May).

In addition to influences deemed important, there are some factors that have been shown to be irrelevant. Generally, stack effect was considered to be of little influence, especially when considering tight buildings (Anggabrata & Wong, 2013). Particulate matter was minimally affected by diurnal variations and wind speed. NO_x's were not considerably affected by wind speed, either (Chan, 2002). Beyond factors shown to be irrelevant or insignificant in general, there are also influences that would not affect this study. Because all samples were taken during daylight hours, there would be not influence from a diurnal affect. All buildings were relatively new and designed to LEED (Leadership in Energy and Environmental Design) Silver or better. Thus all buildings would be considered to have tight construction, diminishing the stack effect and the passage of air contaminants through the building envelope.

In search for factors regarding contaminant levels and relationships, it can be seen that particulate matter, followed by nitrogen dioxide, is more heavily studied than the other criteria air pollutants. Additionally, there is relatively little information on indoor air quality or the relation between indoor and outdoor air quality in the Milwaukee area, or the state of Wisconsin. The Wisconsin Department of Natural Resources (DNR) has approximately 30 air monitors around the state, 5 of which are in the Milwaukee area. However, these air monitors measure outside air concentrations to ensure compliance with the regulations established by the EPA NAAQS (Wisconsin Department of Natural Resources, 2016, November 29). They do not study indoor air quality. Therefore this study will delve into the relationship between indoor and outdoor contaminants in office buildings of the Milwaukee area and provide further commentary into pertinent factors based on data collected.

Methods

Equipment

All meters used were portable and handheld. In indoor locations, meters were set on a table or desk. This location was representative of the breathing zone of a typical employee working at his or her desk. In outdoor locations, meters were set as close as reasonably possible to the outside air intake serving the indoor sampling area. During inclement weather, such as rain or snow, meters were wiped dry as soon as outdoor sampling concluded and would be left to dry completely indoors through evaporation. Both indoors and outdoors, meters were not placed directly next to sources of supply air (SA), return air (RA), exhaust air (EA), heating, cooling, contamination, or other sources that may misrepresent the typical ambient air conditions of the space being sampled.

Multi-head sensor. The multi-head sensor by Aeroqual measured NO_2, O_3, and SO_2 all in ppm. The precision for NO_2, O_3, and SO_2 were measured to 0.001, 0.001, and 0.01, respectively. The meter was set out with the first sensor head to adjust to ambient conditions. Meter was then turned on, in which it entered into a 3 minute warm-up period. It is suggested to wait an additional 7 minutes, to total 10 minutes, to obtain a more accurate evaluation of the contaminant levels. The values were recorded, along with time of recording. The meter was then be shut off and the sensor head was replaced with the sensor for the process to repeat for the next contaminant. This happened until all three contaminants were sampled. On days of extreme cold, the meter, even if fully charged, typically would not run for 30 minutes. Thus, on these days, the sensor remained plugged in, if possible, or ran for the minimum of 3 minutes for the warm-up. Not all locations had available outlets.

Particulate matter sensor. The particulate matter sensor by HoldPeak simultaneously measured $PM_{2.5}$ and PM_{10} in $\mu g/m^3$. The precision for $PM_{2.5}$ and PM_{10} are both to 0.1. The meter was set out to adjust to ambient air conditions, and it was then turned on. The meter did not automatically enter into a warm-up period, thus the meter was let to run approximately 1 minute before recording values and time of measurement. The meter was then turned off and returned to the travel case.

Indoor air quality sensor. The combination indoor air quality (IAQ) sensor measured CO_2 in ppm, CO in ppm, dew point temperature in degrees Celsius (°C), wet bulb temperature in °C, ambient air in °C, and relative humidity in percent (%). The precision for CO_2 and CO, temperatures, and RH are to 1, 0.1, and 0.1, respectively. The meter was set out to adjust to ambient conditions. The meter was then turned on, and automatically entered into a 30 second warm-up period. The aforementioned values were recorded, along with time of recording. The meter was then turned off and returned to travel case. On days of extreme cold, some values received the error "EO2", which the manual defined as "The value is under range." The error message was only received for select outside samples for dew point temperature and wet bulb temperature. Additionally, carbon monoxide read as 0 ppm for the entire duration of sampling. Zero ppm CO is typical; however, the sensor was tested by operator to ensure it was functional.

Locations. Milwaukee is the largest city in the state of Wisconsin, located in the southeastern area of the state. 1.57 million people live in the Milwaukee Metropolitan Area, with 0.60 million living in the City of Milwaukee. Milwaukee is located at 43.0°N, 87.9°W along the west coast of Lake Michigan of the Great Lakes. The Milwaukee, Menominee, and Kinnickinnic Rivers, respectively, from north to south, converge in Milwaukee before flowing into Lake Michigan. See Figure 10. Milwaukee is in climate zone 6a according to ASHRAE 90.1 Figure B-1: Climate Zones for U.S. Locations (ASHRAE Standing Standard Project Committee 90.1, 2010). According to the US EPA NAAQS, Milwaukee has been in attainment since 2014. Please see Table 2 for reference (United States Environmental Protection Agency, 2017, February 13).

Sampling locations were medium sized office buildings in the greater Milwaukee area. Offices were chosen based on accessibility provided through contacts and ability to generally represent Milwaukee. In buildings that included office space and residential, sampling was limited to only the office space. Of the five locations, four were within the zone outlined in Figure 11. The fifth location is in a northern suburb, within the limits of Figure 10. Locations were designated based on location, with the northernmost location as Location A and the southernmost location as Location E.

Location A. Location A was a two-story building in a suburb north of Milwaukee. It was approximately 1 mile from Interstate (I) 43, 0.5 miles from the Milwaukee River, and on a major arterial road. Because Location A was located in the business area of a suburb, Location A had the largest amount of surrounding green space and open surface parking lots.

Indoor sampling area. Indoor sampling was taken at a cubical typical to the office. Cubical locations varied due to the availability of vacant desks. The sampling area was an approximately 34,000 SF open office area of about 225 people and was served by an under floor variable air volume (VAV) box system. Each desk had a personal diffuser to provide air to the breathing zone. The air handling unit (AHU) serving the space was located in a mechanical penthouse on the roof and obtained outside air through a sidewall louver. The AHU utilized an economizer. Several general items are worth noting. The most common industrial practice for a VAV system is to be located overhead in the ceiling and to be served by a variable volume AHU or roof top unit (RTU) with an air-side economizer. Under floor air distribution (UFAD) systems provide better thermal distribution and ventilation than overhead air distribution systems due to the properties of air, i.e. warm air is less dense than cool air. VAV systems modulate the volumetric flow rate of air to maintain temperature control of a space instead of, as formerly used in the building industry, the constant air volume (CAV) system that maintained temperature of a space by modulating the temperature of the air supplied at a constant volumetric flow rate. The CAV system was replaced by the VAV systems largely because VAV systems use

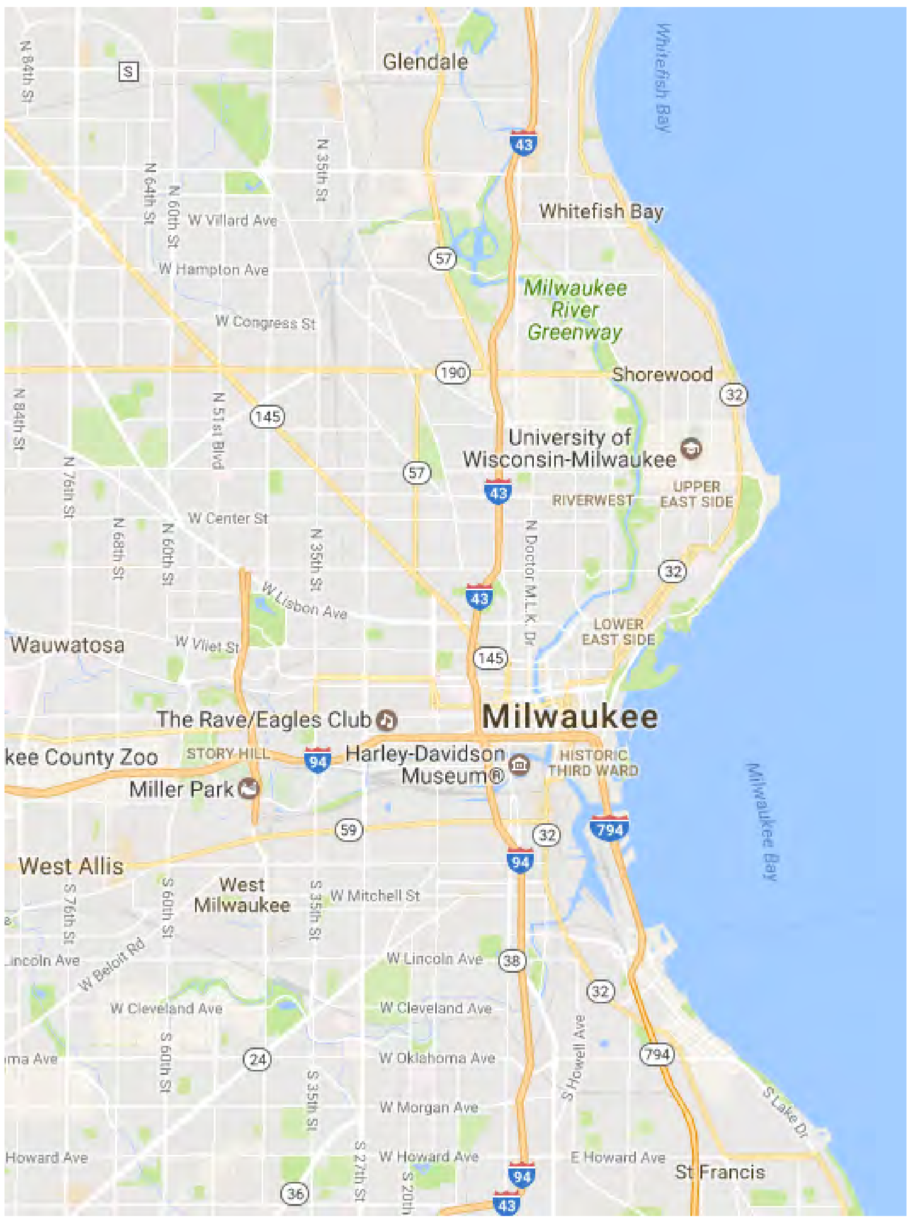

Figure 10. Map of the City of Milwaukee. Adapted from “City of Milwaukee” by Google Maps, 2017. Retrieved from https://www.google.com/maps/@43.0522815,-87.9448038,12z.

Table 2

Attainment According to US EPA NAAQS Provisions for Milwaukee, Wisconsin

County	NAAQS	Area Name	Nonattainment in Year	Redesignation to Maintenance	Classification	Whole or / Part County	Population (2010)	State / County FIPS Codes
WISCONSIN								
Brown Co	Sulfur Dioxide (1971)	Green Bay, WI		02/26/1992		Part	248,004	55/009
Dane Co	Sulfur Dioxide (1971)	Madison, WI	92	07/23/1993		Part	488,074	55/025
Door Co	1-Hour Ozone (1979)-NAAQS revoked	Door Co, WI	92 93 94 95 96 97 98 99 00 01 02	06/16/2003	Rural Transport (Marginal)	Whole	27,785	55/029
Door Co	8-Hour Ozone (1997)-NAAQS revoked	Door Co, WI	04 05 06 07 08 09	07/12/2010	Former Subpart 1	Whole	27,785	55/029
Kenosha Co	1-Hour Ozone (1979)-NAAQS revoked	Milwaukee-Racine, WI	92 93 94 95 96 97 98 99 00 01 02 03 04	/ /	Severe 17	Whole	166,426	55/059
Kenosha Co	8-Hour Ozone (1997)-NAAQS revoked	Milwaukee-Racine, WI	04 05 06 07 08 09 10 11	07/31/2012	Moderate	Whole	166,426	55/059
Kenosha Co	8-Hour Ozone (2008)	Chicago-Naperville, IL-IN-WI	12 13 14 15 16	/ /	Moderate	Part	129,844	55/059
Kewaunee Co	1-Hour Ozone (1979)-NAAQS revoked	Kewaunee Co, WI	92 93 94 95	08/26/1996	Moderate	Whole	20,574	55/061
Kewaunee Co	8-Hour Ozone (1997)-NAAQS revoked	Kewaunee Co, WI	04 05 06 07	05/21/2008	Former Subpart 1	Whole	20,574	55/061
Manitowoc Co	1-Hour Ozone (1979)-NAAQS revoked	Manitowoc Co, WI	92 93 94 95 96 97 98 99 00 01 02	06/16/2003	Moderate	Whole	81,442	55/071
Manitowoc Co	8-Hour Ozone (1997)-NAAQS revoked	Manitowoc Co, WI	04 05 06 07 08 09	07/12/2010	Former Subpart 1	Whole	81,442	55/071
Marathon Co	Sulfur Dioxide (1971)	Rothschild,Rib Mtn,Weston (Marathon Co), WI	92 93 94 95 96 97 98 99 00 01	07/29/2002		Part	134,064	55/073
Milwaukee Co	1-Hour Ozone (1979)-NAAQS revoked	Milwaukee-Racine, WI	92 93 94 95 96 97 98 99 00 01 02 03 04	/ /	Severe 17	Whole	947,735	55/079
Milwaukee Co	8-Hour Ozone (1997)-NAAQS revoked	Milwaukee-Racine, WI	04 05 06 07 08 09 10 11	07/31/2012	Moderate	Whole	947,735	55/079
Milwaukee Co	PM-2.5 (2006)	Milwaukee-Racine, WI	09 10 11 12 13	04/22/2014	Former Subpart 1	Whole	947,735	55/079
Milwaukee Co	Sulfur Dioxide (1971)	Milwaukee, WI	92	07/23/1993		Part	947,779	55/079
Oneida Co	Sulfur Dioxide (1971)	Rhinelander (Oneida County), WI	92 93 94 95 96 97 98 99 00	01/16/2001		Part	35,996	55/085
Oneida Co	Sulfur Dioxide (2010)	Rhinelander, WI	13 14 15 16	/ /		Part	18,054	55/085
Ozaukee Co	1-Hour Ozone (1979)-NAAQS revoked	Milwaukee-Racine, WI	92 93 94 95 96 97 98 99 00 01 02 03 04	/ /	Severe 17	Whole	86,395	55/089
Ozaukee Co	8-Hour Ozone (1997)-NAAQS revoked	Milwaukee-Racine, WI	04 05 06 07 08 09 10 11	07/31/2012	Moderate	Whole	86,395	55/089
Racine Co	1-Hour Ozone (1979)-NAAQS revoked	Milwaukee-Racine, WI	92 93 94 95 96 97 98 99 00 01 02 03 04	/ /	Severe 17	Whole	195,408	55/101

Note. Adopted from "Wisconsin Nonattainment Status for Each County by Year for All Criteria Pollutants" by the US EPA, 13 February 2017. Retrieved from https://www3.epa.gov/airquality/greenbook/anayo_wi.html.

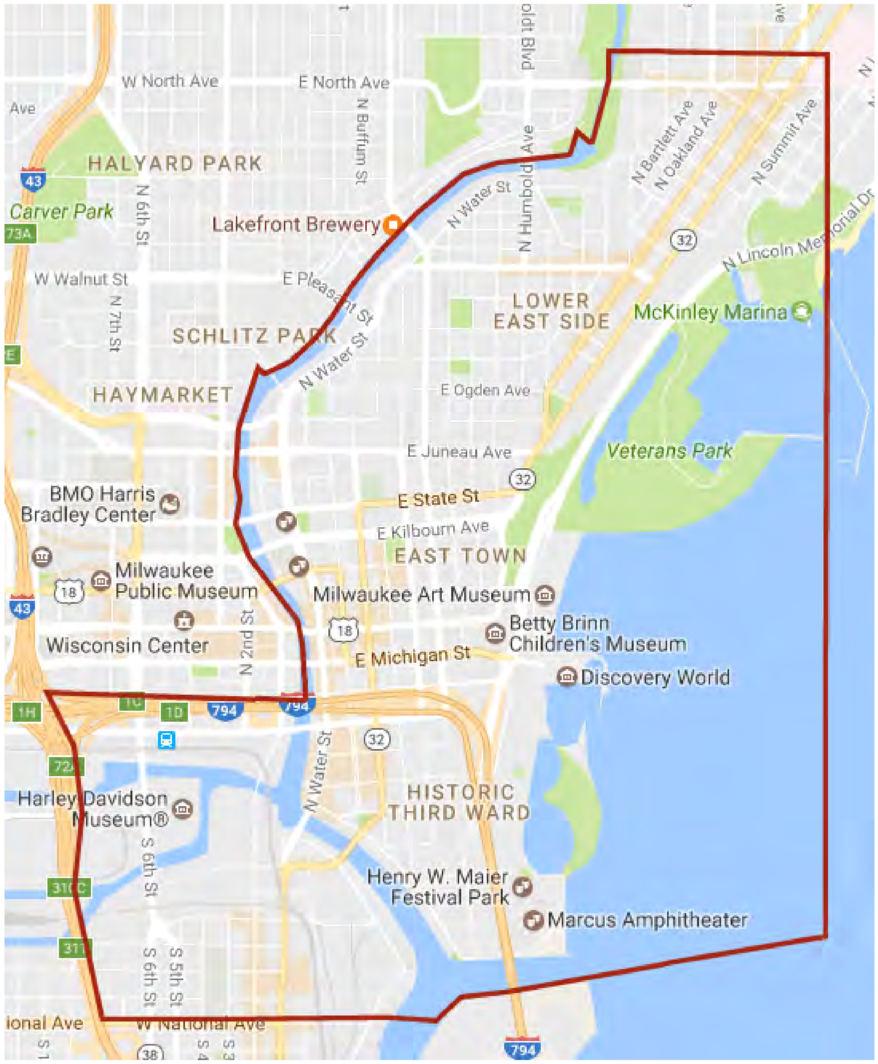

Figure 11. Area map of sampling locations used in the study. This figure outlines four of the five of the sampling locations in this study. The fifth location was in a northern suburb of Milwaukee. Adopted from "City of Milwaukee" by Google Maps, 2017. Retrieved from https://www.google.com/maps/@43.043312,-87.904635,14z.

considerably less energy and do not wear out equipment from excessive on/off cycling. Additionally, AHUs and RTUs both pre-condition air before it is sent to the space to be conditioned by the VAV. AHUs are commonly used in larger facilities where the higher initial cost of customization can be overcome by the savings of operation and maintenance costs.

RTUs are commonly used in smaller facilities and buildings where the pre-designed unitary equipment will suffice the building's needs.

Outdoor sampling area. The outdoor sampling area was on the roof twenty to forty feet horizontally from the sidewall intake louver. The roof was surfaced with a smooth, white, reflective roof coating as a common in a built-up roof. No exhaust equipment or visible means of air contamination was between the sampling location and the intake louver.

Location B. Location B was a multi-story residential and office building, but the office space is located only on the ground floor. It was approximately 0.75 miles from Lake Michigan, less than 500 feet from the Milwaukee River and a paper-product recycling facility, and on a major arterial road. Due to Location B's proximity to the lake and river, there were many public trails and public green spaces. The surrounding neighborhood was a mixture of small to medium businesses and residential.

Indoor sampling area. Indoor sampling was taken at desk typical to the office, or at one of the small tables. Location varied due to availability. The sampling area was an approximately 2,600 SF open office area of about 15 people and was served by an overhead VAV system. The AHU serving the space was located in the mechanical room in the underground parking garage and obtained outside air through an area well. The AHU did not utilize an economizer.

Outdoor sampling area. The outdoor sampling area was on ground level directly above the intake area well serving the AHU. The area well was constructed of concrete, with the ground level pathway nearby being of gravel. The pathway and nearby green space was accessible to residents, but not the public. No exhaust equipment or permanent means of air contamination were visible. However, due to the close proximity to the street and inhabitable green space, temporary sources of pollution, such as smoking, were possible but were not witnessed during sampling.

Location C. Location C was a seven-story office building in downtown. The building was approximately 0.5 miles from Lake Michigan and one major construction site, 0.25 miles from the Milwaukee River and two more major construction sites, and less than 500 feet from I-794, and was on a main arterial road. Because Location C is downtown, there was very little green space, many multi-story buildings, much traffic, and many minor construction sites. In this context, major construction was exemplified as a demolition and/or construction of an entire building or long-term infrastructure project that may have a duration of several months to several years. Minor construction was exemplified as the minor exterior renovation of a building, or a small infrastructure project that may have had a duration of only a few hours to a few weeks.

Indoor sampling area. Indoor sampling was taken at a cubical typical to the office. Location varied due to availability. The sampling area was an approximately 13,000 SF open office area of about 40 people on the 7th floor. The space was served by an under floor VAV system. Each desk had a diffuser to provide air directly to the breathing zone. The AHU that served the space was located exposed on the roof, with the indoor brought in directly into the AHU. The AHU utilized an economizer.

Outdoor sampling area. The outdoor sampling area was at the outside air intake of the AHU. The roof was surfaced with a smooth, white, reflective roof coating as a common in a built-up roof. No exhaust equipment or visible means of air contamination were near the outside air intake.

Location D. Location D was a multi-story residential and office building of the Historic Third Ward. The office space was only located on the ground floor. It was approximately 0.75

miles from two major construction sites, 0.5 miles from I-794 and Milwaukee's wastewater treatment facility, 0.25 miles from active rail lines, and was on the river and a secondary arterial road. Additionally, there was major construction on the lot neighboring the building. It should be noted that the Historic Third Ward was an industrial hub. Therefore, there are active rail lines, and regular boat activity from personal sport boats and industrial barges. Due to the industrial history of the area, there are many two- to five-story buildings that have been converted to residential or mixed use, many surface levels parking lots, and some green space.

Indoor sampling area. Indoor sampling was taken at a desk typical to the office, or at one of the small tables. Location varied due to availability. The sampling area was an approximately 23,000 SF open office area of about 125 people. It was served by an under floor VAV system. The RTU that served the space was exposed on the roof and obtained outside air directly through the outside air intake. The RTU utilized an economizer.

Outdoor sampling area. The outdoor sampling area was on the ground level on the boardwalk between the building and the Milwaukee River. Sampling occurred approximately three stories and some horizontal distance from the outside air intake. Due to code mandated design, it could be assumed, but not guaranteed, that there was no exhaust equipment or permanent means of air contamination within an effectual distance to the outside air intake on the RTU.

Location E. Location E was a six-story office building in Walker's Point. It was approximately 1 mile from Lake Michigan and two major construction sites, 0.75 miles from Milwaukee's wastewater treatment facility, a railroad yard, and I-794, 0.5 miles from I-43, the Kinnickinnic River and Milwaukee River, 0.25 miles from the Menomonee River, and was located on an active rail line, and non-arterial road.

Indoor sampling area. Indoor sampling was taken at one of the small tables in the office. Location varied due to availability. The sampling area was an approximately 5,400 SF open office area of about 30 people. It is served by an overhead VAV system. The RTU that served the space was exposed on the roof. The outside air was obtained through an outside air intake hood. It is assumed the RTU utilized an economizer.

Outdoor sampling area. The outdoor sampling area was on the 6th level balcony approximately 10 feet vertically and 30 feet horizontally away from the RTU. No exhaust equipment of permanent means of air contamination were visible.

Times

Data were collected three times weekly from October 3, 2016 to December 29, 2016. During the third week, October 17 through October 21, data were collected only twice per location for Locations A, B, D, E. No data were collected the week of October 24 through October 28. Sampling was only conducted during business hours, therefore data were not collected while offices were closed due to holidays. The major US holidays of Thanksgiving, on November 24, and Christmas, on December 25, occurred during the sampling period. For Thanksgiving, no data were collected on that Thursday (official holiday) or the following Friday, as many employees were absent. Because Christmas was on a Sunday, the offices officially observed Christmas the following Monday, December 26. Due to the near proximity of Christmas to the official holiday New Year's Day, January 1, a higher than normal percentage of employees were absent from the office.

The typical business hours of each office were as follows:

Location A: 6 am-6pm,

Location B: 8 am-4:30 pm,

Location C: 6 am-6 pm,

Location D: 8 am-5 pm,

Location E: 7 am-4 pm.

Data Analysis

After collection, the data were put into Microsoft Excel. The data were then processed and removed based through physical limitations, probable limitations, equipment errors, and Chauvenet's criterion of rejection. To determine statistically meaningful relationships between data, Excel's regression analysis was utilized. The data were also assessed with an adjusted R^2, log-based graphs, and against varying underlying distributions through the statistical software JMP to determine an appropriate means of presenting and evaluating the data. Data collected can be seen in Appendix A categorized by location. Values deemed as invalid are bolded. Cells missing data were simply left as blank, instead of attempting to reconstruct values. In Appendix B, the data were rearranged by contaminant type. Invalid values were omitted in Appendix B. Values were not reconstructed as to avoid creating a seemingly stronger or weaker relationship than actually existed.

Physical limitations. Data were reviewed with respect to their categorical physical limitations. $PM_{2.5}$, PM_{10}, NO_2, SO_2, O_3, CO, and CO_2 were restricted to positive values. RH, because it was a fractional value represented as a percentage, must have been 0% to 100%. Temperature values were confined to the relationship of TA>WB>DP. No data were removed due to physical limitations.

Probable limitations. Data were reviewed with respect to their categorical probable limitations. All outdoor values and the indoor values of $PM_{2.5}$, PM_{10}, NO_2, SO_2, O_3, and CO had no relevant probable limitations. Outdoor values are designated as having no probable limitations because weather abides by no such rules. Indoor CO_2 levels were to be equal or more than outdoor CO_2 levels due to concentrated human occupation of indoor spaces when compared to outdoor spaces. Indoor RH was restricted to 0% to 65%; values above 65% were considered invalid because all sites implemented a Building Automation System (BAS) that would prevent such high RH levels. It should be noted that indoor RH values above 70% are avoided because of the increased likelihood of indoor environmental quality issues such as mold and a “sticky” feeling on the skin. TA was restricted from 66°F to 84°F. According to ASHRAE Standard 55.1, typical indoor TA range suitable for thermal comfort is approximately 70°F to 75°F. However, on especially cold days, or during the BAS morning start up, the temperature range was extended to 66°F to 84°F accommodate such instances that are valid reasons for the temperature deviation. Also according to ASHRAE Standard 55.1, the acceptable WB range is from 40°F to 70°F and DP range from 0°F to 65°F. Data were removed due to TA and RH values. Due to the relationship between RH, TA, WB, and DP, if any of these four values was determined to be invalid, all four values for the reading were removed from the analysis. It should be noted that values located outside of the aforementioned range were most likely due to inadequate time allotted for the equipment to adjust to ambient conditions.

Equipment errors. Values believed to be erroneous equipment readings were removed. There were two instances in which this occurred. One, as described in the Methods section, was when the temperature was below the equipment’s range of measurement. This only occurred for WB and DP values. The second instance of this, also related to the very low temperatures, was when the reading of the equipment was taken prematurely before the meter had been exposed to the ambient conditions for the recommended time. Such recorded values were the last measured value before the meter died due to exposure. Data points removed due to this were NO_2 values of Week 10, Day 2 for Locations A, B, and E.

Missing data. Instances in which data were missing were left blank. A reconstruction of the data was not attempted as it might have misled the results into a seemingly stronger or weaker correlation than which actually occurred. Missing data occurred during Week 3, when Locations A, B, D, and E were not sampled for a third time; oversight; and when the meter died and was not able to be recharged or rewarmed in a timely manner.

Outlier removal. Chauvenet's criterion of rejection was utilized to remove outliers. Before the outlier removal, each data group consisted of 33 to 36 points. Note that 36 data points represents no missing or removed data. By the limits set by the criterion, 0 to 2 data points were removed to leave a data group of 32 to 36 points for the criteria air pollutants. For the other air parameters, the data groups began at 30 to 36 data points to have 0 to 2 points removed, resulting in 30 to 35 data points retained. Only one round of data rejection was performed according to Chauvenet's criterion.

Regression analysis. A linear regression analysis was performed on the data remaining after the removal process. This statistical analysis method was chosen as an existent or non-existent relationship would be easily identified, such as was done in Chan (2002). The analysis was performed using Excel's built-in linear regression analysis tool. The analysis was performed between variations of data groupings as is discussed in Results and Discussion.

Results and Discussion

In this study, the graphs displaying Indoor versus Outdoor Contaminant Levels were used instead of the graphs displaying I/O Ratios. However, they both are in the appendices for reference. Graphs can be viewed by the different data groupings in Appendices C – I. Regression analyses with R^2 were included on the graphs in Appendices E – I that compare Indoor versus Outdoor Contaminant Levels and I/O Ratio. For brevity, only a graph exemplary of each data grouping was discussed unless an anomaly required explicit discussion. For some data groupings, vertical axes were forced to a standard value for a more easily viewable comparison between graphs displaying similar data groupings. For forced axes, the values were listed in the description of the appropriate appendix. Additionally, all invalid values were omitted from all graphs. Invalid values were only in Appendix A, and were clearly marked. Additionally, all graphs of CO and most graphs indoor O_3 were omitted because the graphs only displayed zero values; thus they contributed no value by being shown graphically.

Data by location

The first data grouping was the raw data as arranged by location. These graphs, as exemplified in Figure 12, were in Appendix C and showed the tabulated values as arranged in Appendix A. The graphs in Appendix C were meant to provide an overview to assist general comparisons between the locations. The left-hand axis of the graph measured the $PM_{2.5}$, PM_{10} in µg/m³ and CO in ppm. The right-hand axes measured NO_2, SO_2, and O_3 in ppm. Breaks in the data lines indicated where data were missing or removed. Location C had, in general, the lowest maximum indoor contamination levels. Location E had, in general, the highest maximum indoor contamination levels. Location B had, in general, the lowest maximum outdoor contamination levels. Location C had, in general, the highest maximum outdoor contamination levels.

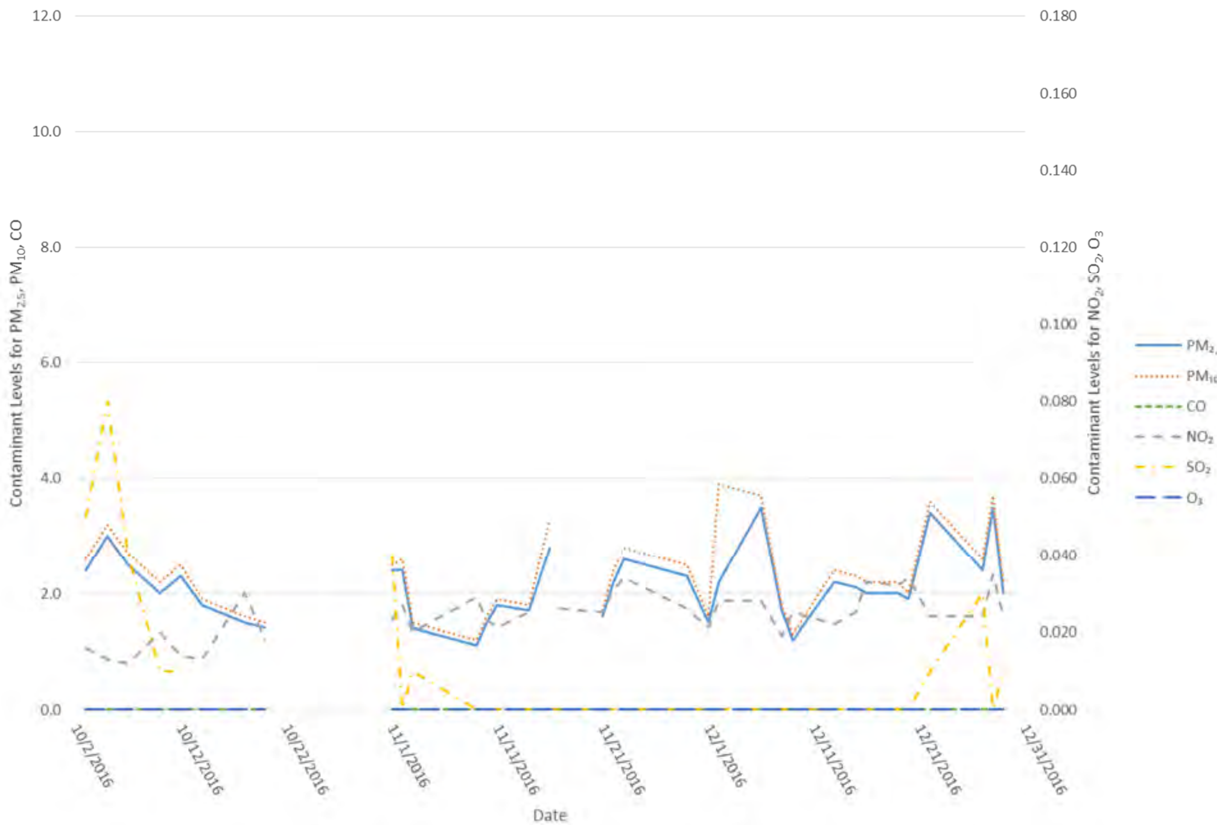

Figure 12. Location A, indoor contaminants as an example of the graphs in Appendix C.

Data by Pollutant Type

The graphs of Appendix D showed the data grouping as arranged by contaminant type for all locations. These graphs, as exemplified by Figure 13, were in Appendix D and show the tabulated values as arranged in Appendix B. Graphs displaying indoor versus outdoor contaminant levels of I/O ratios of $PM_{2.5}$, PM_{10}, and NO_2 were in Appendices E and F and exemplified by Figures 14 and 15, respectively. There was considered to be a significant relationship between indoor and outdoor contaminant levels if the coefficient of determination is greater than 0.4 (R^2>0.4). This coefficient is relatively low due to the nature of the study: the cleanliness of air is impacted by the complex interactions of immediate and long-term actions

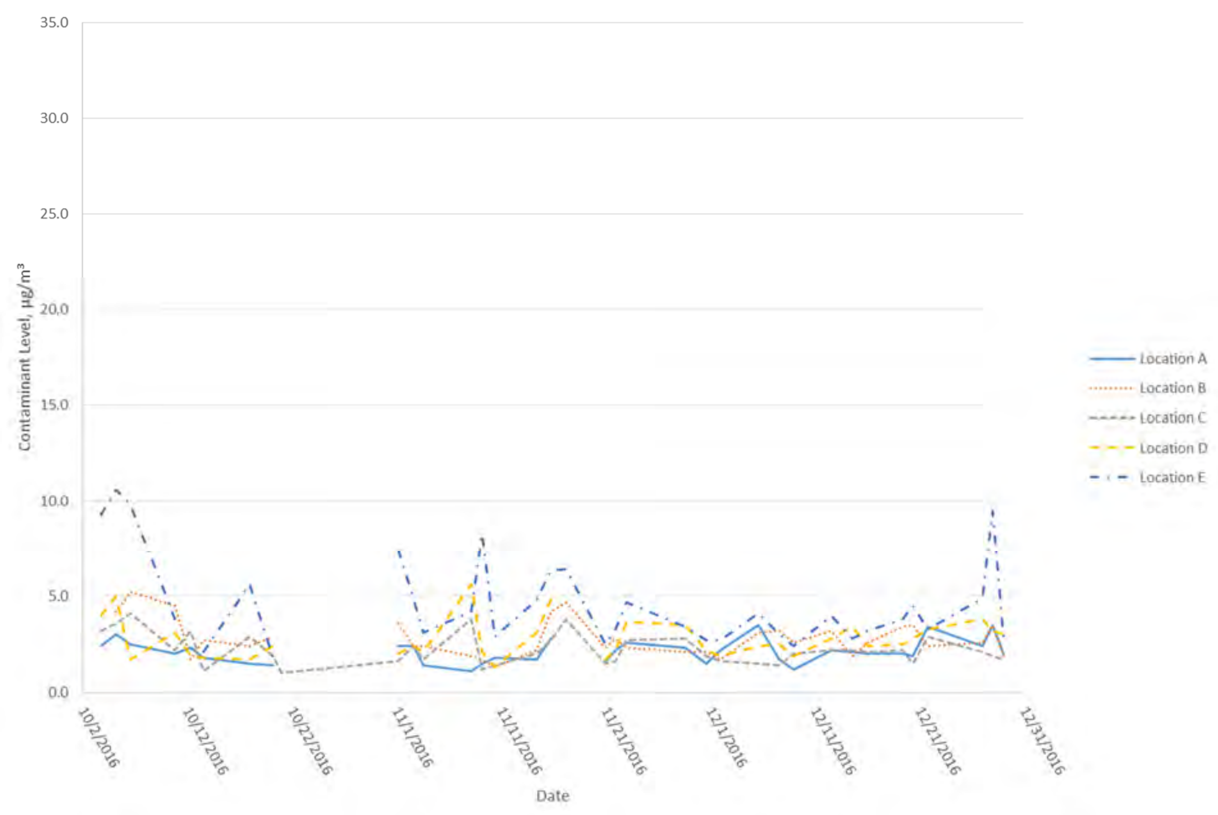

Figure 13. $PM_{2.5}$, indoor as an example of the graphs in Appendix D.

from many sources, which may or may not impact both the indoor and outdoor air quality at a specific location. The precision of the sensors may have also contributed to the lower coefficient levels found in this study. A significant number of values were measured as zero for SO_2, O_3, and CO, thus making the last two graphs irrelevant; because of this, the latter three contaminants do not have comparative graphs. Additionally, data are then grouped by contaminant type and location, as seen in Figure 16, and found in Appendices G-J per contaminant type. A summary of data collected can be seen in Table 3 for the criteria air pollutants, and Table 4 for other air parameters.

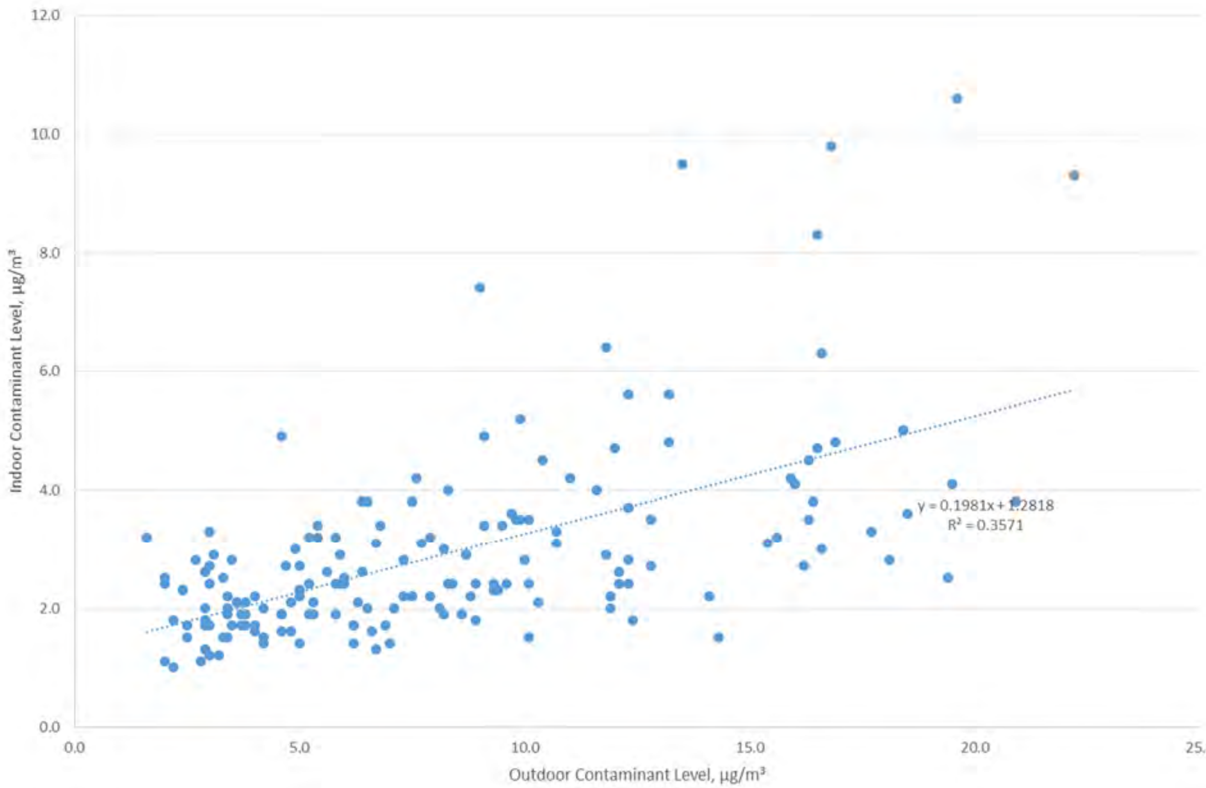

Figure 14. $PM_{2.5}$, indoor vs outdoor contaminant levels as an example of the graphs in Appendix E.

Particulate matter. As was to be expected, PM showed values that roughly coordinated peaks and valleys between the indoor and outdoor values of $PM_{2.5}$ and PM_{10} values. Location E generally had the highest levels of indoor PM, although Location D had the highest indoor PM levels toward the second half of November. Locations A and C had the lowest PM levels indoors. This trend correlates to the filter efficiencies specified for each location. No information on the filter efficiency for Location E was provided, but typical filter efficiencies for RTU's are MERV 5 to MERV 8. Location D, also served by an RTU, utilized a filter to MERV 7. Locations A and C, which were served by AHU's, utilized pre-filters of unspecified efficiency and final filters of MERV 15. Location B utilized a pre-filter of MERV 7 and final

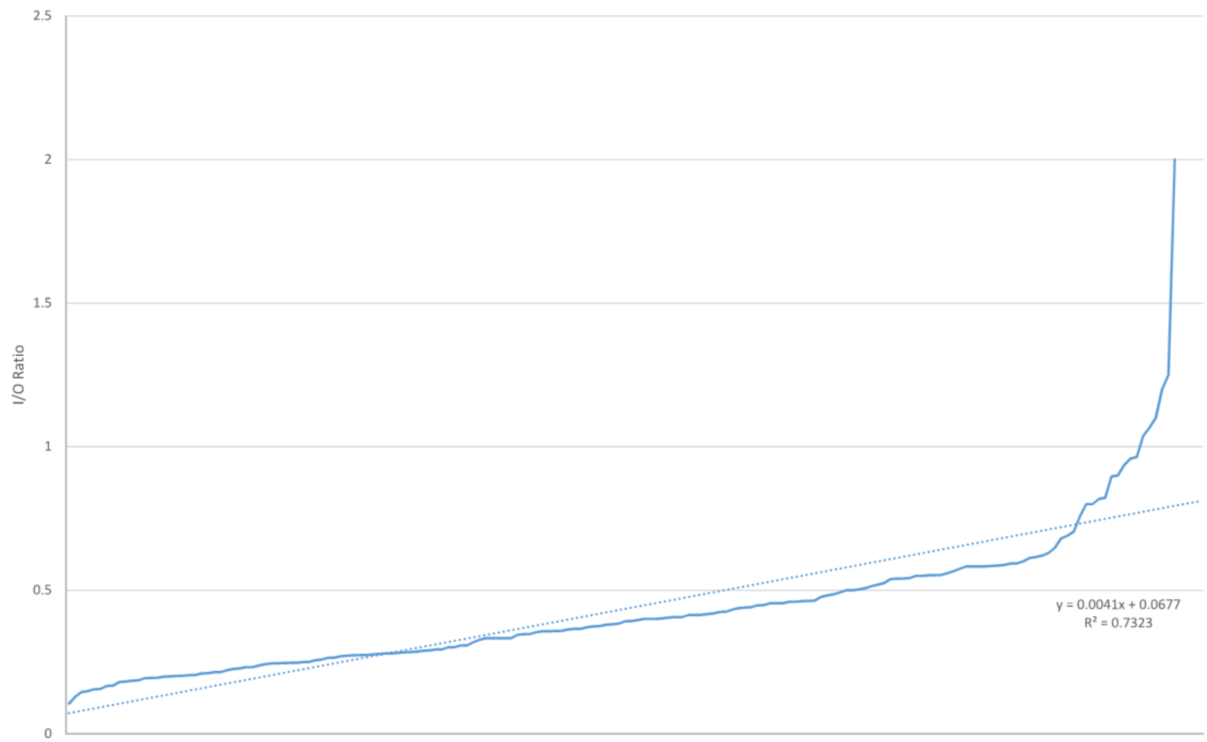

Figure 15. $PM_{2.5}$, I/O ratio as an example of the graphs in Appendix F.

filter of MERV 13. Additionally, the correlation shown between the indoor and outdoor contaminant levels for individual location supported this; more effective filters resulted in lower R^2 values. For $PM_{2.5}$, Locations D and E exhibited a stronger correlation, $R^2 = 0.59$ and $R^2 = 0.61$, respectively, than did Locations A and C, $R^2 = 0.46$ and $R^2 = 0.52$. Location B had $R^2 = 0.44$. PM_{10} showed a significantly weaker correlation between indoor and outdoor contaminant levels in all locations, ranging between $R^2 = 0.27$ and $R^2 = 0.35$. This was because filters more effectively remove the larger particles than the smaller particles. Outdoor PM levels did not have a location with definitively highest of lowest levels. This may be because PM is not highly reactive and thus can be in the air long enough for a wide dispersion across the city. Neither indoor nor outdoor PM exhibited increasing or decreasing trend over the course of this study.

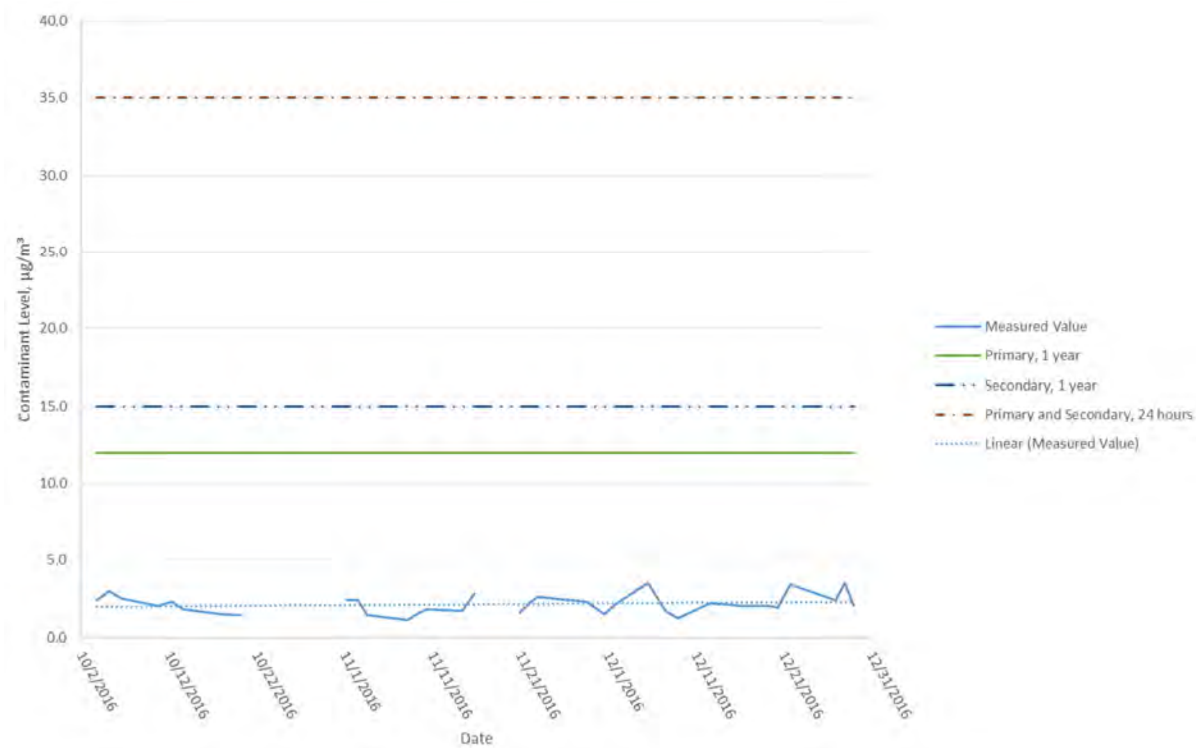

Figure 16. $PM_{2.5}$, Location A, indoor as an example of the graphs in Appendices G-J.

Nitrogen dioxide. No location showed a decisively higher or lower level of indoor NO_2. However, all indoor levels of NO_2 showed an increasing trend as the study progressed. The general increasing trend was most likely due to the increased use of heating systems as the outdoor temperatures decreased. Outdoor levels showed only a very slight increasing trend, except at Location C. The increasing trend may be more prominent indoors than outdoors because as heating systems were used, any contaminants that were dispersing indoors were spread over a smaller volume than contaminants dispersing outdoors. Even though contaminants, i.e. flue gases from boilers, were required to be evacuated directly outside, the volumetric difference, wind, sun and many other factors may help NO_2 to decay or disperse more quickly. Additionally, some people may use personal heaters, such as space heaters, which may

Table 3

Tabulated Summary of the Basic Statistical Values for the Criteria Air Contaminants

	Indoor Location					Outdoor Location				
	A	B	C	D	E	A	B	C	D	E
$PM_{2.5}$ [µg/m³]										
Maximum	3.5	5.2	4.1	5.6	10.6	19.4	16.5	20.9	18.4	22.2
Minimum	1.1	1.3	1.0	1.3	1.8	2.0	2.0	1.6	2.0	2.9
Average	2.1	2.8	2.2	2.8	4.7	8.2	7.4	8.8	7.9	9.4
Median	2.1	2.6	2.1	2.5	3.9	7.1	6.6	7.6	6.7	7.7
Range	2.4	3.9	3.1	4.3	8.8	17.4	14.5	19.3	16.4	19.3
Std. Deviation	0.6	0.9	0.8	1.0	2.4	4.7	3.9	5.1	4.5	5.7
PM_{10}[µg/m³]										
Maximum	3.9	7.3	4.4	8.6	14.2	26.8	22.1	30.5	27.2	29.2
Minimum	1.2	1.4	1.1	1.8	1.9	2.2	2.4	1.7	2.4	3.2
Average	2.3	3.6	2.5	3.5	5.6	10.9	10.1	12.1	10.4	12.8
Median	2.3	3.3	2.3	3.0	4.5	9.6	9.0	9.9	8.3	11.8
Range	2.7	5.9	3.3	6.8	12.3	24.6	19.7	28.8	24.8	26.0
Std. Deviation	0.7	1.6	0.9	1.7	3.0	6.8	6.0	8.1	7.0	7.9
NO_2 [ppm]										
Maximum	0.035	0.046	0.038	0.043	0.041	0.106	0.070	0.079	0.059	0.068
Minimum	0.012	0.002	0.000	0.012	0.003	0.038	0.036	0.038	0.020	0.018
Average	0.024	0.026	0.021	0.026	0.023	0.064	0.054	0.052	0.042	0.052
Median	0.025	0.027	0.023	0.027	0.023	0.061	0.051	0.050	0.044	0.054
Range	0.023	0.044	0.038	0.031	0.038	0.068	0.034	0.041	0.039	0.050
Std. Deviation	0.006	0.010	0.010	0.007	0.009	0.016	0.008	0.010	0.009	0.012
SO_2 [ppm]										
Maximum	0.08	0.12	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.00
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Median	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
Range	0.08	0.12	0.03	0.03	0.04	0.00	0.00	0.00	0.01	0.00
Std. Deviation	0.02	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
O_3 [ppm]										
Maximum	0.000	0.000	0.000	0.000	0.000	0.045	0.041	0.048	0.041	0.037
Minimum	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Average	0.000	0.000	0.000	0.000	0.000	0.014	0.014	0.013	0.013	0.016
Median	0.000	0.000	0.000	0.000	0.000	0.009	0.013	0.011	0.008	0.016
Range	0.000	0.000	0.000	0.000	0.000	0.045	0.041	0.048	0.041	0.037
Std. Deviation	0.000	0.000	0.000	0.000	0.000	0.014	0.012	0.013	0.013	0.011
CO [ppm]										
Maximum	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0
Median	0	0	0	0	0	0	0	0	0	0
Range	0	0	0	0	0	0	0	0	0	0
Std. Deviation	0	0	0	0	0	0	0	0	0	0

Table 4

Tabulated Summary of the Basic Statistical Values for Other Air Parameters

	Indoor Location					Outdoor Location				
	A	B	C	D	E	A	B	C	D	E
CO_2 [ppm]										
Maximum	807	866	743	1009	787	511	471	458	475	463
Minimum	407	457	382	516	476	337	388	372	380	382
Average	562	613	536	691	631	422	419	420	416	418
Median	555	614	522	680	637	417	413	426	407	420
Range	400	409	361	493	311	174	83	86	95	81
Std. Deviation	102	94	94	119	75	33	21	20	24	21
TA [°F]										
Maximum	74.1	75.4	73.2	74.5	74.1	72.0	79.3	72.9	82.6	73.6
Minimum	66.0	68.7	66.0	66.4	66.4	-1.7	-0.6	14.5	16.3	2.7
Average	68.6	72.1	70.9	70.6	70.2	42.5	43.5	45.1	47.6	45.8
Median	68.5	72.1	71.2	70.5	69.9	45.0	43.3	44.5	49.5	46.4
Range	8.1	6.7	7.2	8.1	7.7	73.6	79.9	58.3	66.3	70.9
Std. Deviation	1.6	2.2	1.8	2.2	2.2	18.6	19.2	15.9	17.2	18.6
RH [%]										
Maximum	61.7	60.4	67.5	55.4	63.2	90.8	85.9	92.9	90.1	88.0
Minimum	18.9	8.5	12.3	12.0	13.4	32.1	29.7	30.3	30.8	35.8
Average	36.4	31.5	34.6	31.1	35.4	64.3	61.0	64.6	58.4	63.0
Median	32.4	28.1	30.5	28.9	32.7	63.8	63.4	65.4	59.6	62.2
Range	42.8	51.9	55.2	43.4	49.8	58.7	56.2	62.6	59.3	52.2
Std. Deviation	13.0	17.0	16.2	12.3	15.2	15.4	13.6	15.7	16.2	12.6
DP [°F]										
Maximum	57.7	57.0	59.9	52.0	56.5	62.1	63.7	64.2	63.9	63.7
Minimum	23.2	6.4	16.9	17.2	17.2	2.1	-5.3	1.0	-5.6	-4.5
Average	39.7	36.6	38.9	36.8	39.5	33.2	33.7	33.3	31.6	34.7
Median	37.6	38.5	37.2	37.6	39.1	34.9	34.9	32.8	32.9	34.3
Range	34.6	50.6	43.0	34.7	39.2	59.9	68.9	63.2	69.5	68.2
Std. Deviation	10.2	14.4	12.3	10.7	12.1	15.0	16.5	16.7	16.1	18.0
WB [°F]										
Maximum	63.1	62.6	64.6	60.6	62.4	63.9	64.9	66.4	67.1	66.4
Minimum	45.9	45.9	48.4	47.5	47.7	20.5	19.9	20.8	20.1	19.4
Average	53.6	54.4	54.6	53.5	54.4	42.3	43.6	42.9	42.4	42.6
Median	52.3	53.9	52.9	52.9	53.3	42.5	43.2	43.3	45.1	42.4
Range	17.3	16.7	16.2	13.1	14.8	43.4	45.0	45.5	47.0	47.0
Std. Deviation	4.8	4.7	4.7	3.8	4.9	11.6	12.3	12.6	12.1	14.1

also contribute to indoor NO_2 levels. Outdoor NO_2 levels at Location A were the highest, while levels were the lowest at Location D. While the outdoor NO_2 levels did not coordinate peaks and valleys across locations, it should be noted that Location A had the most erratic values, in relevance to other locations. This may be because NO_2 decays before dispersing far from the source, leaving Location A more isolated from the levels measured at the other locations. There was no significant relationship between indoor and outdoor contaminant levels, as was shown by values of $R^2 = 0.00$ to $R^2 = 0.17$, which may have been due to the nature of the gas.

Sulfur dioxide. Location D had the lowest indoor SO_2 levels. The highest indoor SO_2 levels were by Location B during the first half of the study and Location E during the second half. On November 15, Location B experienced a small fire in a laundry room that was in the same building, but was not associated with the office. The laundry room was on the same level and approximately 50 feet from the indoor sampling site. After this event, a charcoal filter was installed as activated charcoal removes air-borne odors. Activated charcoal also removes SO_2. While not precisely aligning, a noticeable drop in SO_2 was measured after November 10. The events may have been related, as in the days leading up to the fire, the laundry room may have been additionally ventilated, or the piece of equipment may have been turned off. Location A also had higher levels of SO_2 at the beginning of the study than during the remainder of the study, however no reason was found for this. Locations C, D, and E had no trend or very minor decreasing trends for indoor levels through the duration of the study. The outdoors levels for all locations had no increasing or decreasing trend. No indoor versus outdoor relationship could be composed as many indoor SO_2 and nearly all outdoor SO_2 values measured at 0.00 ppm.

Ozone. Indoor levels of O_3 were 0.000 ppm for all but one measurement of 0.003 ppm. This was most likely because O_3 is unstable and requires UV light or specialty equipment to form; therefore it decayed quickly when there was no source. Outdoor O_3 levels did not have a significant increasing or decreasing trend. The peaks and valleys coordinated somewhat across locations in general, but not very exactly. This may have been due to reactivity of O_3 and the complex parameters necessary to form the gas. No correlations could be made between O_3 and other data measured to draw a relationship. Furthermore, because indoor levels measured 0.000 ppm, no indoor versus outdoor relationship can be made.

Carbon monoxide. All indoor and outdoor values of CO were measured to be 0 ppm. Therefore, there were no results to be shown and no relationships to suggest.

Conclusions and Recommendations

In tightly constructed buildings, outdoor air quality in Milwaukee only held a minimal relationship to the indoor air quality of the selected offices, with the exception of $PM_{2.5}$. $PM_{2.5}$, the only criteria air pollutant with a significant relationship between indoor and outdoor air in this study, can be remediated through the use of a higher-rated MERV filter. PM_{10} did not have a strong correlation because of the filtration used in the buildings. NO_2 also did not have a statistically important relationship between indoor and outdoor measurements, most likely due to nature of the gas. Furthermore, SO_2, O_3, and CO had inconclusive relationships due to the numerous "0" values. Particularly for gaseous pollutants, a correlation may have been concluded if the sensors were more precise than what had been used.

Filters for particulate matter are the only filters that are regularly used in a buildings air handling system. However, monitoring other criteria air pollutants may be indicative of indoor air quality issues. For instance, if the heightened SO_2 levels at Location B in the beginning of the study were from the laundry room, the building maintenance staff may have been to prevent the fire instead of remediating the results.

Currently, air quality sensors are typically installed in RTUs or AHUs to indirectly monitor the effectiveness of PM filters. If any location does not have operating sensors, it would be highly recommended to install or fix such sensors to prevent high levels of PM indoors. NO_2 and SO_2 sensors should be considered for installation to ensure adequately low levels of indoor pollution. While installation of the sensors of both gases may be beneficial to all locations, SO_2 sensors at Locations A and B should especially be considered, as these locations resulted in levels of SO_2 higher than permitted than the outside air, as referenced Appendix J. Due to the nature of O_3 and CO, sensors would be necessary where there was a reason to have this gas type in a building, such as an O_3 sensor near an ozone-based water treatment or a CO sensor near a natural gas boiler. For future planning, if any location wished to add certain equipment, they should investigate whether a specialty sensor would be worthwhile.

While this study contributed data about Milwaukee about indoor and outdoor air pollutant relationships, of which both categories are slim in data, it should be viewed as launching point for future studies as there are several ways in which this study could be improved upon. The data presented could be further manipulated to find a relationship between factors other than indoor versus outdoor values of the same criteria air contaminant, such as evaluating a criteria air contaminant against another air parameter (i.e., NO_2 versus RH), or evaluating two criteria air contaminants against each other (i.e., NO_2 versus SO_2). To improve the quality of data in the event the study is duplicated, the options of utilizing a continuous air monitoring system instead of an instantaneous air monitoring, implementing the BAS for monitoring, and the use of more precise monitors should be considered. More precise monitors should be especially considered for the gaseous pollutants. To expand upon this study, one should consider: including lead; evaluating data against other parameters not considered in this study (i.e. costs); determining at what level of pollution in the outdoor air must first be reached before a significant relationship occurs with the indoor air; and cataloging SA and OA volumetric flow rates. For cataloging SA and OA CFMs, whether through the BAS or a separate data-logger, it would be recommended to begin this with the study instead of attempting to retrieve the data after the study.

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Appendix A – Tabulated Raw Data

Data are presented as collected from site. Invalid values, as determined in the Data Analysis section, have been highlighted and bolded. Invalid values only appear in Appendix A, and have been omitted from all other appendices, both tabular and graphical. Notes taken at the time of sampling also only appear in Appendix A and are not included in other appendices for brevity. Notes have been shortened, in length and not in content, through industry standard or generally accepted acronyms and abbreviations.

Table A-1. Location A.

Table A-2. Location B.

Table A-3. Location C.

Table A-4. Location D.

Table A-5. Location E.

Table A-6. Average.

Table A-1

Location A

				Indoor						
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor		
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2	Time
			hh:mm	hh:mm	hh:mm	μg/m³	μg/m³	hh:mm	ppm	hh:mm
Week 1	**Day 1**	**10/3/2016**	6:58	6:40	6:36	2.4	2.6	6:44	0.016	6:56
	Day 2	**10/5/2016**	7:16	6:57	6:47	3.0	3.2	7:15	0.013	7:03
	Day 3	**10/7/2016**	6:55	6:37	6:26	2.5	2.7	6:32	0.012	6:55
Week 2	**Day 1**	**10/10/2016**	6:58	6:40	6:30	2.0	2.2	6:59	0.020	6:36
	Day 2	**10/12/2016**	6:41	6:23	6:13	2.3	2.5	6:42	0.014	6:31
	Day 3	**10/14/2016**	7:05	6:48	6:37	1.8	1.9	6:44	0.013	6:55
Week 3	**Day 1**	**10/18/2016**	16:39	16:21	16:10	1.5	1.6	16:18	0.030	16:29
	Day 2	**10/20/2016**	6:39	6:21	6:10	1.4	1.5	6:18	0.018	6:28
	Day 3									
Week 4	**Day 1**	**11/1/2016**	16:29	16:12	16:01	2.4	2.5	16:30	0.023	16:20
	Day 2	**11/2/2016**	7:22	7:04	6:52	2.4	2.6	7:01	0.027	7:12
	Day 3	**11/3/2016**	7:16	6:57	6:46	1.4	1.5	7:16	0.020	7:05
Week 5	**Day 1**	**11/9/2016**	15:38	15:20	15:10	1.1	1.2	15:39	0.029	15:28
	Day 2	**11/10/2016**	16:22	16:03	15:51	1.5	1.6	16:22	0.023	16:11
	Day 3	**11/11/2016**	6:56	6:37	6:27	1.8	1.9	6:56	0.021	6:45
Week 6	**Day 1**	**11/14/2016**	6:47	6:28	6:17	1.7	1.8	6:48	0.025	6:36
	Day 2	**11/16/2016**	7:44	7:26	7:16	2.8	3.3	7:44	0.000	7:33
	Day 3	**11/17/2016**	11:08	10:41	10:30	4.3	8.9	11:00	0.026	10:49
Week 7	**Day 1**	**11/21/2016**	7:59	7:40	7:31	1.6	1.7	7:58	0.025	7:48
	Day 2	**11/22/2016**	7:28	7:08	7:14	2.2	2.4	7:02	0.031	7:11
	Day 3	**11/23/2016**	7:06	6:49	6:55	2.6	2.8	6:57	0.034	6:46
Week 8	**Day 1**	**11/29/2016**	7:32	7:16	7:08	2.3	2.5	7:29	0.026	7:18
	Day 2	**12/1/2016**	7:21	7:06	7:06	1.5	1.6	7:17	0.021	7:06
	Day 3	**12/2/2016**	7:22	7:04	7:02	2.2	3.9	7:16	0.028	7:05
Week 9	**Day 1**	**12/6/2016**	7:35	7:17	7:18	3.5	3.7	7:28	0.028	7:17
	Day 2	**12/8/2016**	7:56	7:46	7:47	1.7	1.8	7:56	0.019	7:45
	Day 3	**12/9/2016**	7:58	7:42	7:43	1.2	1.3	7:52	0.025	7:42
Week 10	**Day 1**	**12/13/2016**	7:48	7:32	7:34	2.2	2.4	7:42	0.022	7:32
	Day 2	**12/15/2016**	7:45	7:32	7:35	2.1	2.3	7:43	0.025	7:32
	Day 3	**12/16/2016**	7:49	7:36	7:38	2.0	2.2	7:47	0.033	7:36
Week 11	**Day 1**	**12/19/2016**	7:35	7:22	7:23	2.0	2.2	7:33	0.032	7:23
	Day 2	**12/20/2016**	12:39	12:22	12:21	1.9	2.0	12:34	0.034	12:23
	Day 3	**12/22/2016**	10:03	9:49	9:41	3.4	3.6	10:01	0.024	9:51
Week 12	**Day 1**	**12/27/2016**	11:12	11:00	11:02	2.4	2.6	11:10	0.024	10:59
	Day 2	**12/28/2016**	11:06	10:53	10:53	3.5	3.7	11:05	0.035	10:54
	Day 3	**12/29/2016**	10:45	10:34	10:33	2.0	2.2	10:45	0.024	10:35

Table A-1

Location A (Continued)

			Indoor										
			Aeroqual Sensor			IAQ Sensor							
		Date	SO_2	Time	O_3	Time	CO	CO_2	TA		RH	DP	
			ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%	°C	°F
Week 1	**Day 1**	**10/3/2016**	0.05	6:31	0.000	6:34	0	653	20.2	68.4	59.6	12.4	54.3
	Day 2	**10/5/2016**	0.08	6:52	0.000	6:49	0	576	21.4	70.5	61.7	13.8	56.8
	Day 3	**10/7/2016**	0.04	6:43	0.000	6:29	0	530	21.9	71.4	61.7	14.3	57.7
Week 2	**Day 1**	**10/10/2016**	0.01	6:48	0.000	6:29	0	605	20.3	68.5	44.9	8.3	46.9
	Day 2	**10/12/2016**	0.01	6:18	0.000	6:14	0	534	21.3	70.3	51.4	10.9	51.6
	Day 3	**10/14/2016**	0.09	7:06	0.000	6:38	0	620	19.1	66.4	40.6	5.4	41.7
Week 3	**Day 1**	**10/18/2016**	0.12	16:40	0.000	16:09	0	807	26.6	79.9	39.4	11.2	52.2
	Day 2	**10/20/2016**	0.01	6:39	0.000	6:11	0	625	20.3	68.5	51.8	10.1	50.2
	Day 3												
Week 4	**Day 1**	**11/1/2016**	0.04	16:09	0.000	16:02	0	748	23.4	74.1	52.3	13.2	55.8
	Day 2	**11/2/2016**	0.00	7:23	0.000	6:53	0	555	20.4	68.7	56.4	11.5	52.7
	Day 3	**11/3/2016**	0.01	6:54	0.000	6:46	0	630	19.3	66.7	50.2	8.8	47.8
Week 5	**Day 1**	**11/9/2016**	0.00	15:17	0.000	15:10	0	606	21.4	70.5	29.7	3.0	37.4
	Day 2	**11/10/2016**	0.00	16:00	0.000	15:52	0	683	21.8	71.2	32.4	4.6	40.3
	Day 3	**11/11/2016**	0.00	6:34	0.000	6:26	0	512	19.6	67.3	36.5	4.1	39.4
Week 6	**Day 1**	**11/14/2016**	0.00	6:26	0.000	6:16	0	576	20.3	68.5	32.1	2.9	37.2
	Day 2	**11/16/2016**	0.00	7:22	0.000	7:15	0	604	17.3	63.1	46.4	5.8	42.4
	Day 3	**11/17/2016**	0.00	10:39	0.000	10:31	0	632	20.3	68.5	48.5	9.2	48.6
Week 7	**Day 1**	**11/21/2016**	0.00	7:37	0.000	7:29	0	452	19.7	67.5	21.7	-2.9	26.8
	Day 2	**11/22/2016**	0.00	7:00	0.000	7:15	0	523	20.2	68.4	22.8	-1.9	28.6
	Day 3	**11/23/2016**	0.00	6:35	0.000	6:55	0	407	19.9	67.8	35.9	4.4	39.9
Week 8	**Day 1**	**11/29/2016**	0.00	7:07	0.000	7:21	0	418	20.3	68.5	36.8	4.9	40.8
	Day 2	**12/1/2016**	0.00	6:56	0.000	7:09	0	415	20.1	68.2	32.6	3.1	37.6
	Day 3	**12/2/2016**	0.00	6:54	0.000	7:07	0	457	19.9	67.8	31.8	2.3	36.1
Week 9	**Day 1**	**12/6/2016**	0.00	7:06	0.000	7:20	0	420	20.3	68.5	31.4	2.9	37.2
	Day 2	**12/8/2016**	0.00	7:34	0.000	7:49	0	680	19.8	67.6	23.5	-2.1	28.2
	Day 3	**12/9/2016**	0.00	7:31	0.000	7:42	0	474	19.6	67.3	22.2	-2.6	27.3
Week 10	**Day 1**	**12/13/2016**	0.00	7:21	0.000	7:32	0	683	19.7	67.5	23.6	-1.9	28.6
	Day 2	**12/15/2016**	0.00	7:21	0.000	7:33	0	494	18.1	64.6	19.0	-6.2	20.8
	Day 3	**12/16/2016**	0.00	7:26	0.000	7:37	0	473	19.4	66.9	18.9	-4.9	23.2
Week 11	**Day 1**	**12/19/2016**	0.00	7:11	0.000	7:24	0	487	18.9	66.0	19.5	-4.9	23.2
	Day 2	**12/20/2016**	0.00	12:13	0.000	12:22	0	747	21.3	70.3	22.2	-1.4	29.5
	Day 3	**12/22/2016**	0.01	9:40	0.000	9:52	0	455	20.2	68.4	26.4	0.2	32.4
Week 12	**Day 1**	**12/27/2016**	0.03	10:48	0.000	11:02	0	507	20.3	68.5	26.1	0.3	32.5
	Day 2	**12/28/2016**	0.00	10:43	0.000	10:54	0	509	20.4	68.7	27.9	1.2	34.2
	Day 3	**12/29/2016**	0.01	10:23	0.000	10:36	0	565	20.1	68.2	28.9	1.6	34.9

Table A-1

Location A (Continued)

			Indoor		Outdoor					
			IAQ Sensor		Avg.	PM Meter			Aeroqual S.	
		Date	WB		Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			°C	°F	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm	ppm
Week 1	**Day 1**	**10/3/2016**	15.4	59.7	7:15	7:04	8.4	9.1	7:11	0.053
	Day 2	**10/5/2016**	16.6	61.9	7:35	7:29	16.6	18.3	7:30	0.046
	Day 3	**10/7/2016**	17.0	62.6	7:13	7:04	19.4	23.0	7:20	0.044
Week 2	**Day 1**	**10/10/2016**	13.6	56.5	7:15	7:04	8.1	13.2	7:34	0.066
	Day 2	**10/12/2016**	15.1	59.2	7:00	6:51	9.4	10.4	6:56	0.051
	Day 3	**10/14/2016**	11.7	53.1	7:23	7:13	12.4	19.5	7:20	0.090
Week 3	**Day 1**	**10/18/2016**	17.3	63.1	16:57	16:46	2.5	2.7	16:54	0.055
	Day 2	**10/20/2016**	14.2	57.6	6:57	6:45	7.0	7.4	6:54	0.057
	Day 3									
Week 4	**Day 1**	**11/1/2016**	16.9	62.4	16:47	16:35	9.3	11.2	16:44	0.038
	Day 2	**11/2/2016**	15.1	59.2	7:41	7:30	8.9	12.0	7:37	0.063
	Day 3	**11/3/2016**	13.3	55.9	7:34	7:23	6.2	6.7	7:53	0.061
Week 5	**Day 1**	**11/9/2016**	11.8	53.2	15:55	15:45	2.0	2.2	16:14	0.060
	Day 2	**11/10/2016**	12.4	54.3	16:41	16:31	3.3	5.5	16:49	0.050
	Day 3	**11/11/2016**	11.4	52.5	7:14	7:12	2.2	2.4	7:09	0.050
Week 6	**Day 1**	**11/14/2016**	11.2	52.2	7:05	6:55	6.2	13.3	7:24	0.062
	Day 2	**11/16/2016**	11.1	52.0	8:02	7:52	18.1	23.5	8:21	0.058
	Day 3	**11/17/2016**	13.9	57.0	11:36	12:41	16.2	26.8	11:14	0.016
Week 7	**Day 1**	**11/21/2016**	9.2	48.6	8:17	8:06	4.0	4.3	8:35	0.070
	Day 2	**11/22/2016**	9.7	49.5	7:47	7:48	8.8	15.9	7:58	0.098
	Day 3	**11/23/2016**	11.6	52.9	7:22	7:22	12.1	16.0	7:23	0.062
Week 8	**Day 1**	**11/29/2016**	12.0	53.6	7:47	7:34	5.0	5.3	8:04	0.077
	Day 2	**12/1/2016**	11.2	52.2	7:36	7:23	3.4	3.6	7:53	0.059
	Day 3	**12/2/2016**	10.9	51.6	7:39	7:31	3.4	3.6	7:52	0.068
Week 9	**Day 1**	**12/6/2016**	11.3	52.3	7:52	7:53	16.3	25.7	8:03	0.079
	Day 2	**12/8/2016**	9.5	49.1	8:07	8:11	6.2	9.6	8:34	0.064
	Day 3	**12/9/2016**	9.3	48.7	8:14	8:02	3.2	3.4	8:28	0.070
Week 10	**Day 1**	**12/13/2016**	9.5	49.1	8:05	8:07	11.9	16.1		
	Day 2	**12/15/2016**	7.7	45.9	7:58	7:52	3.6	6.2	7:57	0.119
	Day 3	**12/16/2016**	8.6	47.5	8:02	8:00	6.5	6.9	8:03	0.095
Week 11	**Day 1**	**12/19/2016**	8.4	47.1	7:48	7:47	7.1	9.4	7:48	0.106
	Day 2	**12/20/2016**	10.4	50.7	12:55	12:47	8.2	11.4	12:48	0.068
	Day 3	**12/22/2016**	10.3	50.5	10:17	10:12	9.5	11.1	10:16	0.052
Week 12	**Day 1**	**12/27/2016**	10.4	50.7	11:24	11:19	5.9	8.9	11:35	0.058
	Day 2	**12/28/2016**	10.7	51.3	11:19	11:19	9.9	13.1	11:27	0.053
	Day 3	**12/29/2016**	10.7	51.3	10:57	10:53	4.2	4.5	11:07	0.056

Table A-1

Location A (Continued)

			Outdoor									
			Aeroqual Sensor				IAQ Sensor					
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2	TA		RH
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%
Week 1	**Day 1**	**10/3/2016**	7:34	0.00	7:22	0.000	7:08	0	471	11.9	53.4	89.0
	Day 2	**10/5/2016**	7:42	0.00	7:53	0.006	7:21	0	433	18.7	65.7	85.5
	Day 3	**10/7/2016**	7:31	0.00	7:09	0.000	7:01	0	447	19.1	66.4	87.6
Week 2	**Day 1**	**10/10/2016**	7:12	0.00	7:23	0.000	7:05	0	575	7.2	45.0	83.8
	Day 2	**10/12/2016**	7:18	0.00	7:07	0.000	6:49	0	444	15.3	59.5	77.1
	Day 3	**10/14/2016**	7:31	0.00	7:42	0.000	7:11	0	616	12.1	53.8	42.5
Week 3	**Day 1**	**10/18/2016**	17:05	0.00	17:16	0.038	16:46	0	337	21.2	70.2	39.7
	Day 2	**10/20/2016**	7:05	0.00	7:15	0.018	6:46	0	429	10.6	51.1	74.7
	Day 3											
Week 4	**Day 1**	**11/1/2016**	16:54	0.00	17:06	0.027	16:37	0	427	22.2	72.0	49.1
	Day 2	**11/2/2016**	7:48	0.00	7:59	0.006	7:31	0	511	13.3	55.9	70.6
	Day 3	**11/3/2016**	7:42	0.00	7:31	0.000	7:25	0	479	8.3	46.9	74.7
Week 5	**Day 1**	**11/9/2016**	16:03	0.00	15:52	0.029	15:44	0	423	14.9	58.8	32.1
	Day 2	**11/10/2016**	17:00	0.00	16:37	0.026	16:30	0	417	17.8	64.0	35.7
	Day 3	**11/11/2016**	7:30	0.00	7:20	0.021	7:03	0	433	8.6	47.5	66.1
Week 6	**Day 1**	**11/14/2016**	7:13	0.00	7:02	0.000	6:55	0	432	9.5	49.1	51.5
	Day 2	**11/16/2016**	8:10	0.00	8:00	0.002	7:51	0	472	8.7	47.7	54.4
	Day 3	**11/17/2016**	11:24	0.00	11:35	0.045	11:06	0	437	20.6	69.1	50.6
Week 7	**Day 1**	**11/21/2016**	8:24	0.00	8:13	0.034	8:09	0	410	-1.2	29.8	54.5
	Day 2	**11/22/2016**	7:47	0.00	7:36	0.000	7:49	0	472	-0.1	31.8	72.2
	Day 3	**11/23/2016**	7:34	0.00	7:12	0.031	7:23	0	389	7.3	45.1	86.7
Week 8	**Day 1**	**11/29/2016**	7:54	0.00	7:43	0.003	7:44	0	397	6.9	44.4	69.2
	Day 2	**12/1/2016**	7:42	0.00	7:31	0.000	7:33	0	399	4.4	39.9	83.6
	Day 3	**12/2/2016**	7:41	0.00	7:30	0.020	7:42	0	412	1.9	35.4	63.8
Week 9	**Day 1**	**12/6/2016**	7:52	0.00	7:41	0.008	7:53	0	402	3.0	37.4	90.8
	Day 2	**12/8/2016**	8:21	0.00	8:10	0.020	7:21	0	400	-6.3	20.7	62.5
	Day 3	**12/9/2016**	8:17	0.00	8:07	0.025	8:16	0	407	-5.2	22.6	70.5
Week 10	**Day 1**	**12/13/2016**	8:08	0.00	7:58	0.025	8:09	0	419	-12.4	9.7	65.7
	Day 2	**12/15/2016**	8:05	0.00	7:53	0.010	8:06	0	406	-17.7	0.1	57.7
	Day 3	**12/16/2016**	8:09	0.00	7:57	0.000	8:05	0	417	-7.2	19.0	60.1
Week 11	**Day 1**	**12/19/2016**	7:53	0.00	7:43	0.000	7:52	0	427	-18.7	-1.7	63.3
	Day 2	**12/20/2016**	13:10	0.00	12:59	0.033	12:54	0	392	-0.8	30.6	58.2
	Day 3	**12/22/2016**	10:26	0.00			10:17	0	391	2.6	36.7	64.7
Week 12	**Day 1**	**12/27/2016**	11:25	0.00	11:20	0.018	11:25	0	395	-2.1	28.2	61.3
	Day 2	**12/28/2016**	11:12	0.00	11:17	0.000	11:20	0	407	6.4	43.5	46.9
	Day 3	**12/29/2016**	10:51	0.00	10:56	0.031	10:58	0	389	2.9	37.2	54.2

Table A-1

Location A (Continued)

			Outdoor			
			IAQ Sensor			
		Date	DP		WB	
			°C	°F	°C	°F
Week 1	**Day 1**	**10/3/2016**	10.3	50.5	11.3	52.3
	Day 2	**10/5/2016**	16.2	61.2	17.1	62.8
	Day 3	**10/7/2016**	16.7	62.1	17.7	63.9
Week 2	**Day 1**	**10/10/2016**	4.7	40.5	6.2	43.2
	Day 2	**10/12/2016**	11.2	52.2	12.9	55.2
	Day 3	**10/14/2016**	-0.7	30.7	6.8	44.2
Week 3	**Day 1**	**10/18/2016**	6.9	44.4	13.1	55.6
	Day 2	**10/20/2016**	6.7	44.1	8.6	47.5
	Day 3					
Week 4	**Day 1**	**11/1/2016**	11.0	51.8	15.4	59.7
	Day 2	**11/2/2016**	8.7	47.7	10.0	50.0
	Day 3	**11/3/2016**	4.5	40.1	6.0	42.8
Week 5	**Day 1**	**11/9/2016**	-1.2	29.8	7.4	45.3
	Day 2	**11/10/2016**	2.6	36.7	10.1	50.2
	Day 3	**11/11/2016**	2.6	36.7	5.7	42.3
Week 6	**Day 1**	**11/14/2016**	-0.3	31.5	4.5	40.1
	Day 2	**11/16/2016**	1.6	34.9	5.6	42.1
	Day 3	**11/17/2016**	10.0	50.0	14.3	57.7
Week 7	**Day 1**	**11/21/2016**	-10.1	13.8	-4.8	23.4
	Day 2	**11/22/2016**	-4.9	23.2	-1.7	28.9
	Day 3	**11/23/2016**	5.1	41.2	6.2	43.2
Week 8	**Day 1**	**11/29/2016**	1.4	34.5	4.4	39.9
	Day 2	**12/1/2016**	2.9	37.2	4.3	39.7
	Day 3	**12/2/2016**	-4.3	24.3	-0.4	31.3
Week 9	**Day 1**	**12/6/2016**	1.7	35.1	2.4	36.3
	Day 2	**12/8/2016**	-11.2	11.8	E02	E02
	Day 3	**12/9/2016**	-10.3	13.5	-6.4	20.5
Week 10	**Day 1**	**12/13/2016**	-16.6	2.1	E02	E02
	Day 2	**12/15/2016**	E02	E02	E02	E02
	Day 3	**12/16/2016**	-14.1	6.6	E02	E02
Week 11	**Day 1**	**12/19/2016**	E02	E02	E02	E02
	Day 2	**12/20/2016**	-8.1	17.4	-3.1	26.4
	Day 3	**12/22/2016**	-3.5	25.7	0.2	32.4
Week 12	**Day 1**	**12/27/2016**	-8.3	17.1	-4.2	24.4
	Day 2	**12/28/2016**	-4.1	24.6	2.1	35.8
	Day 3	**12/29/2016**	-5.4	22.3	-0.1	31.8

Table A-1

Location A (Continued)

		Date	
			Weather; Notes
Week 1	**Day 1**	**10/3/2016**	Clear, no wind
	Day 2	**10/5/2016**	Partial Clouds, cirrocumulus to W, cumulonimbus to E, no wind
	Day 3	**10/7/2016**	Cirrus and sunny above, overcast on the northern horizon
Week 2	**Day 1**	**10/10/2016**	Clear, no wind
	Day 2	**10/12/2016**	overcast
	Day 3	**10/14/2016**	Clear, calm
Week 3	**Day 1**	**10/18/2016**	Clear, regular wind
	Day 2	**10/20/2016**	Overcast, windy
	Day 3		
Week 4	**Day 1**	**11/1/2016**	Few cirrus clouds, no wind
	Day 2	**11/2/2016**	Steady rain, drizzle
	Day 3	**11/3/2016**	Partially cloudy, mackeral sky, no wind
Week 5	**Day 1**	**11/9/2016**	Few cirrus clouds, some wind
	Day 2	**11/10/2016**	Clear, windy
	Day 3	**11/11/2016**	Cumulus (20%), a few cirrus, regular wind
Week 6	**Day 1**	**11/14/2016**	Cirrus (15%), little wind
	Day 2	**11/16/2016**	Clear, some wind
	Day 3	**11/17/2016**	Sunny, cloudy (80%), cirrus, little wind
Week 7	**Day 1**	**11/21/2016**	Clear, some wind
	Day 2	**11/22/2016**	Cumulus (5%),little wind
	Day 3	**11/23/2016**	Overcast, light sprinkling, some wind
Week 8	**Day 1**	**11/29/2016**	Clear, little wind
	Day 2	**12/1/2016**	Overcast, little wind, light sprinkling
	Day 3	**12/2/2016**	Overcast, some wind
Week 9	**Day 1**	**12/6/2016**	5-10% Cumulus, little wind
	Day 2	**12/8/2016**	20% cirrus/cumulus, some wind
	Day 3	**12/9/2016**	Clear, little wind
Week 10	**Day 1**	**12/13/2016**	Clear, little wind, snow from weekend
	Day 2	**12/15/2016**	Clear, little wind
	Day 3	**12/16/2016**	Overcast, little wind, snowed last night (<0.5")
Week 11	**Day 1**	**12/19/2016**	Clear, little wind, snowed over weekend
	Day 2	**12/20/2016**	Clear, little wind
	Day 3	**12/22/2016**	Clear, some wind, working on cooling tower?
Week 12	**Day 1**	**12/27/2016**	Overcast, steady wind, snow mostly gone, many people gone for holidays
	Day 2	**12/28/2016**	90% cumulus and cirrus, little wind, many people gone for holidays
	Day 3	**12/29/2016**	95% cumulus, gusty, many people gone for the holidays

Table A-2

Location B

				Indoor						
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor		
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2	Time
			hh:mm	hh:mm	hh:mm	μg/m³	μg/m³	hh:mm	ppm	hh:mm
Week 1	**Day 1**	**10/5/2016**	8:58	8:40	8:28	6.0	7.3	8:36	0.018	8:59
	Day 2	**10/6/2016**	13:34	11:58	14:22	4.2	4.5	14:55	0.016	1:43
	Day 3	**10/7/2016**	8:30	8:12	8:02	5.2	5.5	8:31	0.015	8:20
Week 2	**Day 1**	**10/12/2016**	8:36	8:18	8:06	4.5	6.8	8:27	0.024	8:15
	Day 2	**10/13/2016**	14:55	14:37	14:26	1.7	1.8	14:34	0.014	14:45
	Day 3	**10/14/2016**	8:38	8:21	8:09	2.7	7.3	8:17	0.012	8:30
Week 3	**Day 1**	**10/18/2016**	15:00	14:43	14:31	2.4	2.6	14:40	0.025	14:51
	Day 2	**10/20/2016**	8:35	8:18	8:06	2.9	3.1	8:15	0.016	8:26
	Day 3									
Week 4	**Day 1**	**11/2/2016**	9:06	8:48	8:37	3.6	3.8	9:07	0.021	8:56
	Day 2	**11/3/2016**	8:51	8:33	8:22	2.4	9.1	8:53	0.016	8:42
	Day 3	**11/4/2016**	8:35	8:18	8:06	2.4	2.6	8:37	0.009	8:26
Week 5	**Day 1**	**11/9/2016**	8:53	8:36	8:24	1.9	3.7	8:55	0.028	8:44
	Day 2	**11/10/2016**	14:47	14:30	14:19	1.7	1.8	14:49	0.033	14:38
	Day 3	**11/11/2016**	8:30	8:14	8:04	1.3	1.4	8:32	0.021	8:22
Week 6	**Day 1**	**11/14/2016**	8:38	8:20	8:08	2.2	2.3	8:40	0.032	8:28
	Day 2	**11/16/2016**	9:20	9:03	8:53	4.2	5.6	9:21	0.027	9:10
	Day 3	**11/17/2016**	12:39	12:26	12:05	4.7	5.1	12:36	0.026	13:12
Week 7	**Day 1**	**11/21/2016**	9:33	9:16	9:02	2.3	2.5	9:33	0.031	9:22
	Day 2	**11/22/2016**	9:01	8:43	8:44	2.8	3.2	8:54	0.038	8:43
	Day 3	**11/23/2016**	8:40	8:24	8:24	2.3	6.1	8:36	0.024	8:26
Week 8	**Day 1**	**11/29/2016**	9:08	8:53	8:54	2.1	2.3	9:04	0.031	8:53
	Day 2	**12/1/2016**	9:01	8:40	8:24	2.1	2.3	8:54	0.025	8:44
	Day 3	**12/2/2016**	8:56	8:38	8:30	1.7	1.9	8:29	0.032	8:39
Week 9	**Day 1**	**12/6/2016**	9:06	8:51	7:18	3.1	3.9	9:00	0.027	8:49
	Day 2	**12/8/2016**	9:39	9:22	9:15	3.2	3.4	9:34	0.020	9:24
	Day 3	**12/9/2016**	9:28	9:11	9:10	2.6	4.7	9:23	0.002	9:12
Week 10	**Day 1**	**12/13/2016**	9:22	9:04	9:06	3.2	3.4	9:14	0.035	9:04
	Day 2	**12/15/2016**	9:08	8:58	8:59	1.9	2.0	9:09	0.036	8:58
	Day 3	**12/16/2016**	9:18	9:01	9:02	2.6	2.8	9:12	0.046	9:01
Week 11	**Day 1**	**12/19/2016**	9:02	8:45	8:43	3.4	3.6	8:57	0.035	8:46
	Day 2	**12/20/2016**	14:19	14:02	13:59	3.5	4.7	14:13	0.046	14:03
	Day 3	**12/22/2016**	8:38	8:23	8:21	2.4	2.6	8:34	0.039	8:23
Week 12	**Day 1**	**12/27/2016**	12:36	12:19	12:18	2.6	2.8	12:31	0.039	12:21
	Day 2	**12/28/2016**	9:42	9:25	9:16	3.5	4.2	9:39	0.033	9:28
	Day 3	**12/29/2016**	9:17	8:59	8:56	1.9	2.0	9:11	0.031	9:00

Table A-2

Location B (Continued)

			Indoor									
			Aeroqual Sensor			IAQ Sensor						
		Date	SO_2	Time	O_3	Time	CO	CO_2	TA		RH	DP
			ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%	°C
Week 1	**Day 1**	**10/5/2016**	0.03	8:47	0.000	8:30	0	569	22.3	72.1	58.8	13.9
	Day 2	**10/6/2016**	0.08	14:31	0.000	14:23	0	655	22.3	72.1	59.6	13.9
	Day 3	**10/7/2016**	0.02	8:09	0.000	8:01	0	502	21.8	71.2	60.4	13.8
Week 2	**Day 1**	**10/12/2016**	0.01	8:38	0.000	8:07	0	535	21.9	71.4	57.6	13.1
	Day 2	**10/13/2016**	0.02	14:56	0.000	14:25	0	524	20.4	68.7	36.7	5.4
	Day 3	**10/14/2016**	0.02	8:40	0.000	8:09	0	665	17.2	63.0	51.2	7.1
Week 3	**Day 1**	**10/18/2016**	0.12	15:02	0.000	14:31	0	657	23.2	73.8	50.8	12.4
	Day 2	**10/20/2016**	0.00	8:36	0.000	8:07	0	674	20.4	68.7	48.5	9.2
	Day 3											
Week 4	**Day 1**	**11/2/2016**	0.00	8:45	0.000	8:36	0	622	20.9	69.6	60.4	12.9
	Day 2	**11/3/2016**	0.14	8:31	0.000	8:21	0	853	20.8	69.4	49.8	9.7
	Day 3	**11/4/2016**	0.03	8:15	0.000	8:07	0	713	20.6	69.1	47.3	8.6
Week 5	**Day 1**	**11/9/2016**	0.17	8:34	0.000	8:23	0	866	15.2	59.4	54.4	5.2
	Day 2	**11/10/2016**	0.00	14:27	0.000	14:19	0	657	23.5	74.3	29.2	4.2
	Day 3	**11/11/2016**	0.00	8:11	0.000	8:03	0	608	20.4	68.7	39.8	6.2
Week 6	**Day 1**	**11/14/2016**	0.00	8:17	0.000	8:07	0	567	20.7	69.3	32.1	3.6
	Day 2	**11/16/2016**	0.00	9:00	0.000	8:52	0	628	21.1	70.0	42.2	7.8
	Day 3	**11/17/2016**	0.02	12:14	0.000	12:04	0	1061	23.7	74.7	44.2	10.9
Week 7	**Day 1**	**11/21/2016**	0.00	9:11	0.000	9:14	0	619	22.8	73.0	15.9	-4.4
	Day 2	**11/22/2016**	0.00	8:32	0.000	8:45	0	618	23.8	74.8	18.1	-1.8
	Day 3	**11/23/2016**	0.00	8:15	0.000	8:22	0	584	23.7	74.7	31.8	5.8
Week 8	**Day 1**	**11/29/2016**	0.00	8:42	0.000	8:55	0	480	24.1	75.4	28.1	4.5
	Day 2	**12/1/2016**	0.00	8:33	0.000	8:48	0	545	24.1	75.4	25.5	3.1
	Day 3	**12/2/2016**	0.05	8:50	0.000	8:43	0	514	23.7	74.7	20.7	-0.3
Week 9	**Day 1**	**12/6/2016**	0.00	8:08	0.000	8:52	0	541	23.9	75.0	26.3	3.4
	Day 2	**12/8/2016**	0.00	9:13	0.000	9:24	0	610	23.4	74.1	12.7	-6.8
	Day 3	**12/9/2016**	0.00	9:01	0.000	9:13	0	661	23.1	73.6	14.3	-6.1
Week 10	**Day 1**	**12/13/2016**	0.00	8:53	0.000	9:05	0	649	23.2	73.8	11.0	-8.3
	Day 2	**12/15/2016**	0.00	8:48	0.000	9:00	0	583	21.1	70.0	9.5	-12.4
	Day 3	**12/16/2016**	0.00	8:50	0.000	9:00	0	745	21.6	70.9	13.1	-7.9
Week 11	**Day 1**	**12/19/2016**	0.00	8:35	0.000	8:47	0	664	20.8	69.4	8.5	-14.2
	Day 2	**12/20/2016**	0.00	13:52	0.000	14:03	0	703	22.0	71.6	18.0	-3.6
	Day 3	**12/22/2016**	0.00	8:17	0.000	8:23	0	457	22.8	73.0	18.4	-2.0
Week 12	**Day 1**	**12/27/2016**	0.00	12:10	0.000	12:19	0	492	23.1	73.6	14.0	-4.7
	Day 2	**12/28/2016**	0.00	9:17	0.000	9:28	0	594	22.4	72.3	19.2	-2.2
	Day 3	**12/29/2016**	0.00	8:49	0.000	9:03	0	494	22.3	72.1	17.9	-3.7

Table A-2

Location B (Continued)

			Indoor			Outdoor					
			IAQ Sensor			Avg.	PM Meter			Aeroqual S	
		Date	DP	WB		Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			°F	°C	°F	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm	ppm
Week 1	**Day 1**	**10/5/2016**	57.0	17.0	62.6	9:17	9:06	18.8	20.8	9:36	0.043
	Day 2	**10/6/2016**	57.0	16.9	62.4	15:10	15:00	11.0	11.7	15:18	0.036
	Day 3	**10/7/2016**	56.8	16.8	62.2	8:47	8:37	9.9	15.7	8:43	0.048
Week 2	**Day 1**	**10/12/2016**	55.6	16.4	61.5	8:54	8:45	10.4	17.3	8:52	0.060
	Day 2	**10/13/2016**	41.7	12.2	54.0	15:14	15:05	3.5	3.7	15:20	0.068
	Day 3	**10/14/2016**	44.8	11.6	52.9	8:55	8:45	5.0	5.9	9:03	0.059
Week 3	**Day 1**	**10/18/2016**	54.3	16.5	61.7	15:18	15:06	2.0	2.4	15:16	0.044
	Day 2	**10/20/2016**	48.6	13.9	57.0	8:53	8:42	8.7	13.0	8:50	0.065
	Day 3										
Week 4	**Day 1**	**11/2/2016**	55.2	15.9	60.6	9:24	9:16	9.7	15.7	9:31	0.050
	Day 2	**11/3/2016**	49.5	14.4	57.9	9:09	8:58	8.3	8.8	9:27	0.041
	Day 3	**11/4/2016**	47.5	13.7	56.7	8:52	8:41	9.6	17.3	9:11	0.047
Week 5	**Day 1**	**11/9/2016**	41.4	9.9	49.8	9:11	8:59	4.6	9.3	9:30	0.051
	Day 2	**11/10/2016**	39.6	13.2	55.8	15:04	14:53	2.9	8.4	15:23	0.045
	Day 3	**11/11/2016**	43.2	12.1	53.8	8:47	8:35	6.7	9.0	8:55	0.051
Week 6	**Day 1**	**11/14/2016**	38.5	11.6	52.9	8:56	8:45	7.5	10.6	9:04	0.051
	Day 2	**11/16/2016**	46.0	13.6	56.5	9:37	9:26	15.9	22.0	9:55	0.047
	Day 3	**11/17/2016**	51.6	15.9	60.6	12:53	12:40	16.5	22.1	13:12	0.049
Week 7	**Day 1**	**11/21/2016**	24.1	10.2	50.4	9:49	9:38	2.4	2.6	9:57	0.067
	Day 2	**11/22/2016**	28.8	11.3	52.3	9:18	9:20	2.7	2.9	9:29	0.051
	Day 3	**11/23/2016**	42.4	13.7	56.7	8:55	8:52	9.3	10.1	9:11	0.055
Week 8	**Day 1**	**11/29/2016**	40.1	13.4	56.1	9:22	9:11	5.3	5.6	9:39	0.061
	Day 2	**12/1/2016**	37.6	12.9	55.2	9:21	8:50	4.8	5.1	9:28	0.059
	Day 3	**12/2/2016**	31.5	11.7	53.1	9:14	9:04	3.8	4.0	9:27	0.052
Week 9	**Day 1**	**12/6/2016**	38.1	12.9	55.2	9:21	9:13	15.4	20.6	9:35	0.054
	Day 2	**12/8/2016**	19.8	10.1	50.2	9:56	9:49	5.4	5.7	10:10	0.054
	Day 3	**12/9/2016**	21.0	10.0	50.0	9:45	9:40	2.9	3.2	9:58	0.063
Week 10	**Day 1**	**12/13/2016**	17.1	9.6	49.3	9:40	9:41	5.8	6.1	9:51	0.049
	Day 2	**12/15/2016**	9.7	8.1	46.6	9:18	9:14	3.7	4.8	9:19	0.120
	Day 3	**12/16/2016**	17.8	8.9	48.0	9:35	9:38	5.6	5.9	9:36	0.063
Week 11	**Day 1**	**12/19/2016**	6.4	7.7	45.9	9:19	9:13	9.1	10.5	9:32	0.070
	Day 2	**12/20/2016**	25.5	10.1	50.2	14:36	14:28	10.1	10.9	14:38	0.055
	Day 3	**12/22/2016**	28.4	10.8	51.4	8:53	8:47	12.3	15.1	8:46	0.064
Week 12	**Day 1**	**12/27/2016**	23.5	10.4	50.7	12:52	12:43	6.4	6.8	13:06	0.050
	Day 2	**12/28/2016**	28.0	10.6	51.1	9:59	9:52	9.8	17.2	10:12	0.047
	Day 3	**12/29/2016**	25.3	10.3	50.5	9:35	9:29	3.8	4.0	9:38	0.050

Table A-2

Location B (Continued)

			Outdoor									
			Aeroqual Sensor				IAQ Sensor					
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2	TA		RH
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%
Week 1	**Day 1**	**10/5/2016**	9:13	0.00	9:24	0.000	9:09	0	444	19.1	66.4	85.8
	Day 2	**10/6/2016**	15:07	0.00	15:29	0.006	14:59	0	436	20.2	68.4	85.9
	Day 3	**10/7/2016**	8:54	0.00	9:04	0.016	8:39	0	433	19.5	67.1	83.2
Week 2	**Day 1**	**10/12/2016**	9:14	0.00	9:03	0.000	8:40	0	443	19.2	66.6	67.0
	Day 2	**10/13/2016**	15:09	0.00	15:31	0.009	15:05	0	422	4.4	39.9	37.1
	Day 3	**10/14/2016**	8:52	0.00	9:13	0.000	8:44	0	444	11.4	52.5	50.3
Week 3	**Day 1**	**10/18/2016**	15:27	0.00	15:37	0.021	15:07	0	413	26.3	79.3	36.0
	Day 2	**10/20/2016**	9:01	0.00	9:11	0.014	8:41	0	435	10.6	51.1	67.0
	Day 3											
Week 4	**Day 1**	**11/2/2016**	9:21	0.00	9:42	0.000	9:14	0	567	15.2	59.4	73.3
	Day 2	**11/3/2016**	9:17	0.07	9:06	0.000	8:57	0	471	14.3	57.7	63.5
	Day 3	**11/4/2016**	8:59	0.00	8:49	0.000	8:40	0	526	14.3	57.7	50.5
Week 5	**Day 1**	**11/9/2016**	9:19	0.00	9:08	0.002	9:00	0	448	8.7	47.7	57.5
	Day 2	**11/10/2016**	15:12	0.00	15:01	0.023	14:54	0	413	20.1	68.2	29.7
	Day 3	**11/11/2016**	9:05	0.00	8:44	0.013	8:37	0	435	10.6	51.1	54.2
Week 6	**Day 1**	**11/14/2016**	9:15	0.00	8:53	0.004	8:47	0	438	9.1	48.4	59.6
	Day 2	**11/16/2016**	9:44	0.00	9:34	0.003	9:27	0	434	11.1	52.0	68.4
	Day 3	**11/17/2016**	13:01	0.00	12:50	0.016	12:42	0	449	20.8	69.4	47.4
Week 7	**Day 1**	**11/21/2016**	10:08	0.00	9:46	0.041	9:40	0	397	-0.8	30.6	58.3
	Day 2	**11/22/2016**	9:18	0.00	9:07	0.013	9:19	0	399	4.7	40.5	67.2
	Day 3	**11/23/2016**	9:00	0.00	8:50	0.023	8:46	0	422	6.3	43.3	99.9
Week 8	**Day 1**	**11/29/2016**	9:28	0.00	9:17	0.015	9:19	0	388	7.7	45.9	66.2
	Day 2	**12/1/2016**	9:17	0.00	9:07	0.000	10:05	0	402	4.9	40.8	77.1
	Day 3	**12/2/2016**	9:17	0.00	9:06	0.016	9:16	0	406	2.9	37.2	63.3
Week 9	**Day 1**	**12/6/2016**	9:24	0.00	9:13	0.012	9:24	0	393	5.8	42.4	74.7
	Day 2	**12/8/2016**	9:58	0.00	9:47	0.021	10:00	0	402	-5.8	21.6	62.4
	Day 3	**12/9/2016**	9:47	0.00	9:36	0.034	9:45	0	403	-4.8	23.4	61.0
Week 10	**Day 1**	**12/13/2016**	9:39	0.00	9:28	0.022	9:41	0	406	-11.2	11.8	56.8
	Day 2	**12/15/2016**	9:23	0.00	9:15	0.008	9:20	0	408	-16.9	1.6	54.7
	Day 3	**12/16/2016**	9:47	0.00	9:26	0.000	9:30	0	409	-7.8	18.0	34.4
Week 11	**Day 1**	**12/19/2016**	9:21	0.00	9:10	0.026	9:20	0	431	-18.1	-0.6	67.4
	Day 2	**12/20/2016**	14:49	0.00	14:27	0.030	14:40	0	391	1.5	34.7	48.7
	Day 3	**12/22/2016**	9:10	0.00	8:59	0.023	8:45	0	400	0.9	33.6	70.1
Week 12	**Day 1**	**12/27/2016**	12:56	0.00	12:45	0.022	12:54	0	393	-2.5	27.5	66.5
	Day 2	**12/28/2016**	10:01	0.00	9:51	0.005	10:00	0	414	2.6	36.7	63.5
	Day 3	**12/29/2016**	9:49	0.00	9:28	0.036	9:32	0	390	-0.2	31.6	64.9

Table A-2

Location B (Continued)

			Outdoor			
			IAQ Sensor			
		Date	DP		WB	
			°C	°F	°C	°F
Week 1	**Day 1**	**10/5/2016**	16.7	62.1	17.5	63.5
	Day 2	**10/6/2016**	17.6	63.7	18.3	64.9
	Day 3	**10/7/2016**	16.5	61.7	17.6	63.7
Week 2	**Day 1**	**10/12/2016**	12.9	55.2	15.2	59.4
	Day 2	**10/13/2016**	4.4	39.9	10.1	50.2
	Day 3	**10/14/2016**	1.2	34.2	6.6	43.9
Week 3	**Day 1**	**10/18/2016**	8.9	48.0	16.4	61.5
	Day 2	**10/20/2016**	5.0	41.0	7.4	45.3
	Day 3					
Week 4	**Day 1**	**11/2/2016**	10.7	51.3	12.3	54.1
	Day 2	**11/3/2016**	6.9	44.4	10.4	50.7
	Day 3	**11/4/2016**	3.9	39.0	8.7	47.7
Week 5	**Day 1**	**11/9/2016**	1.0	33.8	5.2	41.4
	Day 2	**11/10/2016**	1.8	35.2	10.8	51.4
	Day 3	**11/11/2016**	1.5	34.7	6.3	43.3
Week 6	**Day 1**	**11/14/2016**	1.6	34.9	5.7	42.3
	Day 2	**11/16/2016**	5.6	42.1	8.1	46.6
	Day 3	**11/17/2016**	8.0	46.4	13.9	57.0
Week 7	**Day 1**	**11/21/2016**	-7.9	17.8	-3.2	26.2
	Day 2	**11/22/2016**	-0.8	30.6	2.4	36.3
	Day 3	**11/23/2016**	6.1	43.0	6.1	43.0
Week 8	**Day 1**	**11/29/2016**	1.8	35.2	4.9	40.8
	Day 2	**12/1/2016**	1.3	34.3	3.4	38.1
	Day 3	**12/2/2016**	-3.6	25.5	0.3	32.5
Week 9	**Day 1**	**12/6/2016**	1.7	35.1	3.9	39.0
	Day 2	**12/8/2016**	-11.8	10.8	E02	E02
	Day 3	**12/9/2016**	-11.3	11.7	-6.7	19.9
Week 10	**Day 1**	**12/13/2016**	-18.7	-1.7	E02	E02
	Day 2	**12/15/2016**	E02	E02	E02	E02
	Day 3	**12/16/2016**	-20.7	-5.3	E02	E02
Week 11	**Day 1**	**12/19/2016**	E02	E02	E02	E02
	Day 2	**12/20/2016**	-8.2	17.2	-1.8	28.8
	Day 3	**12/22/2016**	-3.9	25.0	-0.8	30.6
Week 12	**Day 1**	**12/27/2016**	-7.8	18.0	-4.2	24.4
	Day 2	**12/28/2016**	-3.5	25.7	0.3	32.5
	Day 3	**12/29/2016**	-6.0	21.2	-2.2	28.0

Table A-2

Location B (Continued)

		Date	
			Weather; Notes
Week 1	Day 1	10/5/2016	Cirrocumulus, little wind; OA intake/area well by natural space (ll), river (ll), & main road
	Day 2	10/6/2016	Overcast, soft breeze
	Day 3	10/7/2016	Partial clouds, cirrus, steady wind
Week 2	Day 1	10/12/2016	Mostly cloudy, some wind
	Day 2	10/13/2016	Clear, calm
	Day 3	10/14/2016	Clear, some wind
Week 3	Day 1	10/18/2016	Clear, sunny, little wind
	Day 2	10/20/2016	Overcast, some wind
	Day 3		
Week 4	Day 1	11/2/2016	Steady rain
	Day 2	11/3/2016	Slight wind, mackeral sky, vacuuming for all indoor contaminants
	Day 3	11/4/2016	Clear, no wind
Week 5	Day 1	11/9/2016	Clear, little wind
	Day 2	11/10/2016	Clear, very windy
	Day 3	11/11/2016	Cumulus (40%), strong, steady wind
Week 6	Day 1	11/14/2016	Cirrus (5%), some wind
	Day 2	11/16/2016	Overcast, no wind
	Day 3	11/17/2016	Cirrus (5%), no wind, Thanksgiving inside, generator around corner for vacuum sys. in stair
Week 7	Day 1	11/21/2016	Clear, some wind
	Day 2	11/22/2016	100% cloudy, no wind
	Day 3	11/23/2016	Overcast, light sprinkling, little wind
Week 8	Day 1	11/29/2016	Clear, little wind
	Day 2	12/1/2016	Overcast, little wind
	Day 3	12/2/2016	Overcast, little wind
Week 9	Day 1	12/6/2016	95% Cumulus, little wind
	Day 2	12/8/2016	Gusty, <5% cumulus
	Day 3	12/9/2016	Clear, little wind, cleaning personnel working for PM
Week 10	Day 1	12/13/2016	Clear, little wind, snow on ground from weekend
	Day 2	12/15/2016	Clear, some wind
	Day 3	12/16/2016	Overcast, little wind, snowed last night
Week 11	Day 1	12/19/2016	Clear, little wind, snow on ground from weekend
	Day 2	12/20/2016	Clear, some wind, construction on street
	Day 3	12/22/2016	Clear, little wind
Week 12	Day 1	12/27/2016	Overcast, little wind, snow mostly melted, some people gone for holidays
	Day 2	12/28/2016	Overcast, little wind
	Day 3	12/29/2016	Clear, gusty, many people gone for holiday

Table A-3

Location C

				Indoor						
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor		
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2	Time
			hh:mm	hh:mm	hh:mm	μg/m³	μg/m³	hh:mm	ppm	hh:mm
Week 1	**Day 1**	**10/4/2016**	7:01	6:41	6:31	3.2	3.4	6:48	0.011	6:58
	Day 2	**10/5/2016**	10:58	10:40	10:29	3.6	3.8	10:59	0.018	10:36
	Day 3	**10/6/2016**	7:19	7:00	6:48	4.1	4.4	7:08	0.003	6:57
Week 2	**Day 1**	**10/11/2016**	6:57	6:39	6:31	2.2	2.4	6:37	0.019	6:59
	Day 2	**10/12/2016**	14:46	14:28	14:17	3.2	3.4	14:47	0.011	14:36
	Day 3	**10/13/2016**	7:09	6:50	6:41	1.1	1.2	6:46	0.012	6:57
Week 3	**Day 1**	**10/18/2016**	7:27	7:09	6:59	2.9	3.1	7:27	0.019	7:16
	Day 2	**10/20/2016**	13:43	13:25	13:13	1.9	3.5	13:22	0.014	13:33
	Day 3	**10/21/2016**	6:58	6:40	6:30	1.0	1.1	6:37	0.015	6:48
Week 4	**Day 1**	**11/1/2016**	7:49	7:32	7:22	1.6	1.7	7:39	0.022	7:50
	Day 2	**11/3/2016**	15:36	15:19	15:09	2.4	2.6	15:37	0.023	15:26
	Day 3	**11/4/2016**	6:27	6:11	6:07	1.7	1.8	6:15	0.008	6:26
Week 5	**Day 1**	**11/8/2016**	7:45	7:26	7:15	3.8	4.0	7:46	0.026	7:34
	Day 2	**11/9/2016**	11:41	11:43	11:35	1.2	1.3	11:59	0.025	11:49
	Day 3	**11/10/2016**	8:01	7:43	7:32	1.4	1.5	8:02	0.028	7:51
Week 6	**Day 1**	**11/15/2016**	7:46	7:27	7:15	2.0	2.2	7:47	0.024	7:35
	Day 2	**11/16/2016**	12:35	12:17	12:07	2.7	3.8	12:36	0.022	12:25
	Day 3	**11/17/2016**	16:01	15:44	15:32	3.8	4.0	16:03	0.030	15:52
Week 7	**Day 1**	**11/21/2016**	13:04	12:48	12:38	1.5	1.6	13:01	0.014	12:50
	Day 2	**11/22/2016**	12:26	12:09	12:08	1.6	1.7	12:20	0.030	12:10
	Day 3	**11/23/2016**	12:09	11:53	11:43	2.7	2.9	12:07	0.027	11:56
Week 8	**Day 1**	**11/28/2016**	8:04	7:48	7:36	2.8	4.2	8:01	0.000	7:51
	Day 2	**11/30/2016**	7:39	7:22	7:09	1.9	2.0	7:36	0.025	7:25
	Day 3	**12/2/2016**	12:26	12:10	12:06	1.6	1.7	12:22	0.020	12:11
Week 9	**Day 1**	**12/5/2016**	7:29	7:12	7:13	1.5	1.6	7:23	0.000	7:12
	Day 2	**12/7/2016**	7:59	7:41	7:44	1.4	1.5	7:51	0.024	7:39
	Day 3	**12/9/2016**	13:09	12:54	12:52	2.0	2.2	13:05	0.017	12:54
Week 10	**Day 1**	**12/12/2016**	8:09	7:52	7:54	2.2	2.4	8:02	0.024	7:51
	Day 2	**12/14/2016**	8:03	7:44	7:46	2.2	2.5	7:32	0.019	7:43
	Day 3	**12/16/2016**	13:26	13:10	13:09	2.1	2.3	13:21	0.037	13:10
Week 11	**Day 1**	**12/20/2016**	7:44	7:23	7:15	2.2	2.4	7:36	0.034	7:25
	Day 2	**12/21/2016**	7:44	7:28	7:30	1.5	1.6	7:38	0.038	7:27
	Day 3	**12/22/2016**	13:07	12:52	12:50	2.9	3.1	13:01	0.034	12:50
Week 12	**Day 1**	**12/27/2016**	7:49	7:32	7:24	2.1	2.3	7:45	0.031	7:34
	Day 2	**12/28/2016**	13:19	13:02	13:00	1.9	2.0	13:15	0.033	13:04
	Day 3	**12/29/2016**	7:48	7:30	7:24	1.7	1.8	7:44	0.029	7:33

Table A-3

Location C (Continued)

			Indoor									
			Aeroqual Sensor			IAQ Sensor						
		Date	SO_2	Time	O_3	Time	CO	CO_2	TA		RH	DP
			ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%	°C
Week 1	**Day 1**	**10/4/2016**	0.03	6:36	0.000	6:34	0	453	22.8	73.0	62.9	15.5
	Day 2	**10/5/2016**	0.01	10:48	0.000	10:31	0	643	22.4	72.3	56.6	13.4
	Day 3	**10/6/2016**	0.04	7:20	0.000	6:50	0	478	22.2	72.0	64.7	15.3
Week 2	**Day 1**	**10/11/2016**	0.00	6:43	0.000	6:29	0	743	22.6	72.7	48.2	11.4
	Day 2	**10/12/2016**	0.02	14:25	0.000	14:16	0	821	21.0	69.8	67.5	14.9
	Day 3	**10/13/2016**	0.00	7:08	0.000	6:40	0	522	20.3	68.5	40.3	6.3
Week 3	**Day 1**	**10/18/2016**	0.01	7:06	0.000	7:01	0	463	21.8	71.2	59.3	13.5
	Day 2	**10/20/2016**	0.00	13:44	0.000	13:14	0	697	20.5	68.9	44.4	7.5
	Day 3	**10/21/2016**	0.00	6:59	0.000	6:29	0	499	19.4	66.9	38.8	4.7
Week 4	**Day 1**	**11/1/2016**	0.00	7:28	0.000	7:22	0	525	21.1	70.0	40.0	7.1
	Day 2	**11/3/2016**	0.00	15:16	0.000	15:09	0	618	21.3	70.3	55.4	11.8
	Day 3	**11/4/2016**	0.00	6:05	0.000	6:06	0	586	18.9	66.0	48.1	7.9
Week 5	**Day 1**	**11/8/2016**	0.00	7:23	0.000	7:14	0	560	22.6	72.7	43.0	9.4
	Day 2	**11/9/2016**	0.00	11:38	0.000	11:36	0	539	21.4	70.5	28.1	2.3
	Day 3	**11/10/2016**	0.00	7:39	0.000	7:31	0	533	19.9	67.8	30.5	2.1
Week 6	**Day 1**	**11/15/2016**	0.03	7:24	0.000	7:15	0	518	19.6	67.3	52.0	8.9
	Day 2	**11/16/2016**	0.00	12:14	0.000	12:05	0	693	18.7	65.7	54.5	9.2
	Day 3	**11/17/2016**	0.00	15:42	0.000	15:33	0	703	22.9	73.2	45.6	10.7
Week 7	**Day 1**	**11/21/2016**	0.03	12:39	0.000	12:55	0	555	22.4	72.3	17.2	-3.7
	Day 2	**11/22/2016**	0.00	11:59	0.000	12:10	0	572	21.7	71.1	25.7	1.1
	Day 3	**11/23/2016**	0.00	11:45	0.000	11:56	0	507	22.4	72.3	33.6	5.7
Week 8	**Day 1**	**11/28/2016**	0.00	7:40	0.000	7:52	0	491	21.9	71.4	34.7	5.7
	Day 2	**11/30/2016**	0.00	7:15	0.000	7:27	0	501	22.4	72.3	27.5	2.9
	Day 3	**12/2/2016**	0.00	12:01	0.000	12:11	0	566	21.8	71.2	22.7	-0.3
Week 9	**Day 1**	**12/5/2016**	0.00	7:01	0.000	7:13	0	442	21.8	71.2	24.3	0.5
	Day 2	**12/7/2016**	0.00	7:29	0.000	7:45	0	469	21.0	69.8	20.8	-2.3
	Day 3	**12/9/2016**	0.04	12:44	0.000	12:55	0	701	21.1	70.0	20.6	-2.7
Week 10	**Day 1**	**12/12/2016**	0.00	7:40	0.000	7:55	0	550	22.1	71.8	18.8	-2.9
	Day 2	**12/14/2016**	0.00	7:54	0.000	7:47	0	472	21.9	71.4	12.3	-8.4
	Day 3	**12/16/2016**	0.00	12:58	0.000	13:12	0	642	21.2	70.2	16.8	-4.9
Week 11	**Day 1**	**12/20/2016**	0.00	7:14	0.000	7:25	0	403	21.8	71.2	13.0	-7.7
	Day 2	**12/21/2016**	0.00	7:17	0.000	7:28	0	440	22.3	72.1	18.1	-3.1
	Day 3	**12/22/2016**	0.00	12:40	0.000	12:59	0	457	22.1	71.8	22.1	-0.5
Week 12	**Day 1**	**12/27/2016**	0.00	7:23	0.000	7:36	0	388	22.3	72.1	16.5	-4.3
	Day 2	**12/28/2016**	0.00	12:53	0.000	13:01	0	444	22.4	72.3	19.1	-2.2
	Day 3	**12/29/2016**	0.00	7:22	0.000	7:31	0	382	22.4	72.3	20.9	-1.0

Table A-3

Location C (Continued)

			Indoor			Outdoor					
			IAQ Sensor			Avg.	PM Meter			Aeroqual S	
		Date	DP	WB		Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			°F	°C	°F	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm	ppm
Week 1	**Day 1**	**10/4/2016**	59.9	18.1	64.6	7:20	7:09	15.6	20.2	7:28	0.040
	Day 2	**10/5/2016**	56.1	16.8	62.2	11:16	11:05	18.5	23.3	11:24	0.038
	Day 3	**10/6/2016**	59.5	17.7	63.9	7:38	7:28	16.0	16.7	7:45	0.047
Week 2	**Day 1**	**10/11/2016**	52.5	15.7	60.3	7:15	7:03	7.3	7.7	7:12	0.056
	Day 2	**10/12/2016**	58.8	17.1	62.8	15:04	14:53	1.6	1.7	15:02	0.041
	Day 3	**10/13/2016**	43.3	12.6	54.7	7:28	7:17	2.8	3.8	7:25	0.079
Week 3	**Day 1**	**10/18/2016**	56.3	16.6	61.9	7:45	7:34	11.8	15.5	8:04	0.042
	Day 2	**10/20/2016**	45.5	13.2	55.8	14:02	13:51	5.2	5.5	13:59	0.050
	Day 3	**10/21/2016**	40.5	11.6	52.9	7:16	7:04	2.2	2.4	7:13	0.069
Week 4	**Day 1**	**11/1/2016**	44.8	13.1	55.6	8:07	7:58	6.6	7.0	8:14	0.061
	Day 2	**11/3/2016**	53.2	15.5	59.9	15:54	15:44	12.1	15.0	16:12	0.042
	Day 3	**11/4/2016**	46.2	12.7	54.9	6:44	6:34	6.9	7.2	6:51	0.082
Week 5	**Day 1**	**11/8/2016**	48.9	14.8	58.6	8:05	7:56	20.9	30.5	8:23	0.044
	Day 2	**11/9/2016**	36.1	11.6	52.9	11:39	12:07	3.0	3.2	11:34	0.052
	Day 3	**11/10/2016**	35.8	11.1	52.0	8:20	8:09	5.0	5.7	8:40	0.047
Week 6	**Day 1**	**11/15/2016**	48.0	13.4	56.1	8:05	7:55	11.9	19.2	8:24	0.053
	Day 2	**11/16/2016**	48.6	13.2	55.8	12:54	12:41	16.2	26.8	13:10	0.042
	Day 3	**11/17/2016**	51.3	15.6	60.1	16:19	16:09	16.4	23.0	16:26	0.070
Week 7	**Day 1**	**11/21/2016**	25.3	10.2	50.4	13:20	13:07	4.2	4.5	13:26	0.070
	Day 2	**11/22/2016**	34.0	11.2	52.2	12:42	12:40	4.6	4.9	12:55	0.050
	Day 3	**11/23/2016**	42.3	13.1	55.6	12:25	12:13	12.8	19.1	12:32	0.052
Week 8	**Day 1**	**11/28/2016**	42.3	12.9	55.2	8:20	8:07	10.0	12.6	8:36	0.063
	Day 2	**11/30/2016**	37.2	12.1	53.8	7:56	7:48	8.6	13.5	8:11	0.047
	Day 3	**12/2/2016**	31.5	10.8	51.4	12:43	12:34	4.8	5.0	12:57	0.052
Week 9	**Day 1**	**12/5/2016**	32.9	11.1	52.0	7:47	7:40	10.1	14.0	8:00	0.057
	Day 2	**12/7/2016**	27.9	10.0	50.0	8:16	8:12	4.2	4.5	8:27	0.049
	Day 3	**12/9/2016**	27.1	9.9	49.8	13:25	13:19	2.9	4.0	13:39	0.058
Week 10	**Day 1**	**12/12/2016**	26.8	10.3	50.5	8:26	8:20	14.1	19.6	8:40	0.050
	Day 2	**12/14/2016**	16.9	9.1	48.4	8:21	8:20	7.9	12.0	8:33	0.049
	Day 3	**12/16/2016**	23.2	9.4	48.9	13:43	13:33	10.3	29.6	13:48	0.053
Week 11	**Day 1**	**12/20/2016**	18.1	9.2	48.6	8:05	8:00	5.0	7.0	8:16	0.044
	Day 2	**12/21/2016**	26.4	10.4	50.7	8:00	7:50	14.3	21.0	8:05	0.052
	Day 3	**12/22/2016**	31.1	10.9	51.6	13:23	13:15	8.7	11.6	13:17	0.056
Week 12	**Day 1**	**12/27/2016**	24.3	10.1	50.2	8:06	7:56	6.3	6.7	8:22	0.046
	Day 2	**12/28/2016**	28.0	10.6	51.1	13:35	13:26	5.3	8.2	13:40	0.038
	Day 3	**12/29/2016**	30.2	10.9	51.6	8:06	7:58	3.7	3.9	8:11	0.048

Table A-3

Location C (Continued)

			Outdoor									
			Aeroqual Sensor				IAQ Sensor					
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2	TA		RH
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%
Week 1	**Day 1**	**10/4/2016**	7:17	0.00	7:39	0.002	7:11	0	432	17.2	63.0	92.1
	Day 2	**10/5/2016**	11:12	0.00	11:35	0.016	11:08	0	431	22.7	72.9	67.6
	Day 3	**10/6/2016**	7:34	0.00	7:56	0.051	7:30	0	429	19.1	66.4	83.3
Week 2	**Day 1**	**10/11/2016**	7:34	0.00	7:23	0.000	7:05	0	450	17.2	63.0	62.1
	Day 2	**10/12/2016**	15:13	0.00	15:24	0.000	14:51	0	429	13.8	56.8	74.5
	Day 3	**10/13/2016**	7:36	0.00	7:46	0.000	7:18	0	441	5.4	41.7	65.7
Week 3	**Day 1**	**10/18/2016**	7:41	0.00	7:52	0.003	7:35	0	424	21.4	70.5	80.3
	Day 2	**10/20/2016**	14:10	0.00	14:21	0.016	13:52	0	426	13.8	56.8	52.0
	Day 3	**10/21/2016**	7:23	0.00	7:34	0.000	7:07	0	433	7.2	45.0	61.5
Week 4	**Day 1**	**11/1/2016**	8:25	0.00	8:04	0.009	7:55	0	440	10.7	51.3	51.5
	Day 2	**11/3/2016**	16:01	0.00	15:51	0.000	15:42	0	458	17.3	63.1	60.5
	Day 3	**11/4/2016**	7:02	0.00	6:41	0.000	6:32	0	448	10.0	50.0	65.3
Week 5	**Day 1**	**11/8/2016**	8:12	0.00	8:01	0.017	7:53	0	440	13.3	55.9	75.3
	Day 2	**11/9/2016**	11:22	0.00	11:12	0.002	12:04	0	430	19.4	66.9	30.3
	Day 3	**11/10/2016**	8:29	0.00	8:18	0.031	8:08	0	436	9.9	49.8	48.1
Week 6	**Day 1**	**11/15/2016**	8:12	0.00	8:02	0.009	7:54	0	487	11.6	52.9	65.4
	Day 2	**11/16/2016**	12:59	0.00	12:48	0.012	12:52	0	434	14.9	58.8	53.2
	Day 3	**11/17/2016**	16:36	0.00	16:15	0.007	16:09	0	438	17.6	63.7	60.2
Week 7	**Day 1**	**11/21/2016**	13:37	0.00	13:15	0.027	13:18	0	410	5.6	42.1	41.4
	Day 2	**11/22/2016**	12:43	0.00	12:32	0.036	12:44	0	398	5.4	41.7	71.2
	Day 3	**11/23/2016**	12:43	0.00	12:21	0.015	12:18	0	421	6.8	44.2	92.9
Week 8	**Day 1**	**11/28/2016**	8:26	0.00	8:15	0.014	8:18	0	395	7.1	44.8	89.9
	Day 2	**11/30/2016**	8:00	0.00	7:50	0.000	7:54	0	434	2.0	35.6	80.7
	Day 3	**12/2/2016**	12:46	0.00	12:35	0.032	12:45	0	395	2.8	37.0	53.6
Week 9	**Day 1**	**12/5/2016**	7:49	0.00	7:38	0.012	7:50	0	411	1.2	34.2	90.7
	Day 2	**12/7/2016**	8:17	0.00	8:06	0.000	8:20	0	403	-5.1	22.8	72.5
	Day 3	**12/9/2016**	13:28	0.00	13:18	0.048	13:22	0	398	-1.4	29.5	37.6
Week 10	**Day 1**	**12/12/2016**	8:30	0.00	8:19	0.011	8:25	0	406	-6.3	20.7	74.2
	Day 2	**12/14/2016**	8:21	0.00	8:10	0.000	8:25	0	410	-9.7	14.5	57.9
	Day 3	**12/16/2016**	13:59	0.00	13:37	0.007	13:38	0	406	-5.7	21.7	39.8
Week 11	**Day 1**	**12/20/2016**	8:05	0.00	7:55	0.021	8:10	0	418	-6.0	21.2	61.9
	Day 2	**12/21/2016**	8:15	0.00	7:54	0.000	7:59	0	432	-1.8	28.8	73.8
	Day 3	**12/22/2016**	13:38	0.00	13:28	0.033	13:18	0	395	4.2	39.6	53.7
Week 12	**Day 1**	**12/27/2016**	8:11	0.00	8:00	0.020	8:03	0	390	-4.6	23.7	69.8
	Day 2	**12/28/2016**	13:51	0.00	13:29	0.027	13:31	0	372	5.9	42.6	44.1
	Day 3	**12/29/2016**	8:21	0.00	8:00	0.032	8:00	0	391	-1.1	30.0	72.5

Table A-3

Location C (Continued)

			Outdoor			
			IAQ Sensor			
		Date	DP		WB	
			°C	°F	°C	°F
Week 1	**Day 1**	**10/4/2016**	15.9	60.6	16.4	61.5
	Day 2	**10/5/2016**	16.4	61.5	18.6	65.5
	Day 3	**10/6/2016**	16.2	61.2	17.2	63.0
Week 2	**Day 1**	**10/11/2016**	10.2	50.4	13.1	55.6
	Day 2	**10/12/2016**	9.8	49.6	11.6	52.9
	Day 3	**10/13/2016**	-0.3	31.5	2.6	36.6
Week 3	**Day 1**	**10/18/2016**	17.9	64.2	19.1	66.4
	Day 2	**10/20/2016**	3.8	38.8	8.7	47.7
	Day 3	**10/21/2016**	0.3	32.5	4.1	39.4
Week 4	**Day 1**	**11/1/2016**	1.8	35.2	6.6	43.9
	Day 2	**11/3/2016**	9.7	49.5	12.7	54.9
	Day 3	**11/4/2016**	3.3	37.9	6.8	44.2
Week 5	**Day 1**	**11/8/2016**	9.1	48.4	10.9	51.6
	Day 2	**11/9/2016**	2.4	36.3	11.1	52.0
	Day 3	**11/10/2016**	-0.1	31.8	5.6	42.1
Week 6	**Day 1**	**11/15/2016**	5.4	41.7	8.2	46.8
	Day 2	**11/16/2016**	5.5	41.9	10.0	50.0
	Day 3	**11/17/2016**	9.9	49.8	13.0	55.4
Week 7	**Day 1**	**11/21/2016**	-6.6	20.1	1.0	33.8
	Day 2	**11/22/2016**	0.6	33.1	3.4	38.1
	Day 3	**11/23/2016**	5.8	42.4	6.3	43.3
Week 8	**Day 1**	**11/28/2016**	5.6	42.1	6.3	43.3
	Day 2	**11/30/2016**	-0.9	30.4	0.8	33.4
	Day 3	**12/2/2016**	-5.8	21.6	-0.3	31.5
Week 9	**Day 1**	**12/5/2016**	-0.1	31.8	0.7	33.3
	Day 2	**12/7/2016**	-9.2	15.4	-6.2	20.8
	Day 3	**12/9/2016**	-14.1	6.6	-4.8	23.4
Week 10	**Day 1**	**12/12/2016**	-10.2	13.6	E02	E02
	Day 2	**12/14/2016**	-16.3	2.7	E02	E02
	Day 3	**12/16/2016**	-17.2	1.0	E02	E02
Week 11	**Day 1**	**12/20/2016**	-12.1	10.2	E02	E02
	Day 2	**12/21/2016**	-5.9	21.4	-3.2	26.2
	Day 3	**12/22/2016**	-4.5	23.9	0.8	33.4
Week 12	**Day 1**	**12/27/2016**	-9.2	15.4	-6.0	21.2
	Day 2	**12/28/2016**	-5.4	22.3	1.6	34.9
	Day 3	**12/29/2016**	-5.3	22.5	-2.6	27.3

Table A-3

Location C (Continued)

		Date	Weather; Notes
Week 1	Day 1	10/4/2016	Cloudy, not much wind
	Day 2	10/5/2016	Full coverage cloudy w/ sun shining through
	Day 3	10/6/2016	Overcast, steady wind; construction nearby about 2 blocks away, one is façade
Week 2	Day 1	10/11/2016	Mostly cloudy, steady wind
	Day 2	10/12/2016	Overcast, windy
	Day 3	10/13/2016	Clear, calm
Week 3	Day 1	10/18/2016	Partially cloudy, windy
	Day 2	10/20/2016	Overcast, some wind
	Day 3	10/21/2016	Partially cloudy, some wind
Week 4	Day 1	11/1/2016	Partially cloudy, sunny, regular wind
	Day 2	11/3/2016	Clear, little wind
	Day 3	11/4/2016	Clear, little wind
Week 5	Day 1	11/8/2016	Partially cloudy, windy
	Day 2	11/9/2016	Clear, little wind
	Day 3	11/10/2016	Very windy, clear
Week 6	Day 1	11/15/2016	Overcast, some wind
	Day 2	11/16/2016	Overcast, no wind
	Day 3	11/17/2016	Cirrus (40%), little wind
Week 7	Day 1	11/21/2016	Clear, little wind
	Day 2	11/22/2016	Overcast, some wind
	Day 3	11/23/2016	Break in rain, overcast, some wind
Week 8	Day 1	11/28/2016	Overcast, windy
	Day 2	11/30/2016	Clear, little wind
	Day 3	12/2/2016	Overcast, little wind
Week 9	Day 1	12/5/2016	Overcast, some wind
	Day 2	12/7/2016	40% cirrus, steady wind
	Day 3	12/9/2016	15% cumulus, little wind
Week 10	Day 1	12/12/2016	70% cumulus, some wind, snow from weekend
	Day 2	12/14/2016	40% cumulus, little wind
	Day 3	12/16/2016	Overcast, little wind
Week 11	Day 1	12/20/2016	30% cirrus, gusty, snow on ground from weekend
	Day 2	12/21/2016	Overcast, little wind
	Day 3	12/22/2016	Clear, little wind
Week 12	Day 1	12/27/2016	Overcast, some wind, snow is mostly gone
	Day 2	12/28/2016	Overcast, gusty, many people gone for holiday, maintenance on AHU
	Day 3	12/29/2016	Clear, gusty, many people gone for holidays

Table A-4

Location D

				Indoor					
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor	
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			hh:mm	hh:mm	hh:mm	$\mu g/m^3$	$\mu g/m^3$	hh:mm	ppm
Week 1	**Day 1**	**10/3/2016**	8:48	9:01	8:19	4.0	4.1	9:01	0.002
	Day 2	**10/5/2016**	13:54	14:06	13:26	5.0	5.5	14:09	0.023
	Day 3	**10/7/2016**	14:47	14:22	14:55	1.7	1.8	14:27	0.013
Week 2	**Day 1**	**10/10/2016**	8:48	9:09	8:51	3.1	3.3	9:41	0.025
	Day 2	**10/13/2016**	16:29	16:09	15:53	1.9	2.0	16:08	0.027
	Day 3	**10/14/2016**	16:26	16:22	16:30	1.8	1.9	16:05	0.015
Week 3	**Day 1**	**10/18/2016**	18:19	18:00	17:47	1.7	1.8	18:20	0.019
	Day 2	**10/20/2016**	15:03	14:50	14:38	2.4	2.6	14:48	0.019
	Day 3								
Week 4	**Day 1**	**11/1/2016**	14:47	14:33	14:37	2.0	2.2	14:31	0.026
	Day 2	**11/3/2016**	16:57	16:40	16:30	2.4	2.6	16:59	0.016
	Day 3	**11/4/2016**	12:54	13:11	13:01	2.1	3.0	13:07	0.012
Week 5	**Day 1**	**11/8/2016**	10:14	10:26	10:18	5.6	8.6	10:38	0.013
	Day 2	**11/9/2016**	7:29	7:11	7:01	2.1	2.3	7:29	0.027
	Day 3	**11/11/2016**	12:55	12:34	12:18	1.3	6.0	12:57	0.022
Week 6	**Day 1**	**11/14/2016**	12:26	16:47	16:45	3.1	3.3	17:00	0.034
	Day 2	**11/15/2016**	9:19	9:37	9:26	4.8	5.1	9:58	0.026
	Day 3	**11/18/2016**	8:35	9:01	8:41	9.4	10.6	9:36	0.021
Week 7	**Day 1**	**11/21/2016**	14:48	15:29	15:28	1.7	1.8	15:51	0.033
	Day 2	**11/22/2016**	14:08	14:54	15:33	2.2	2.4	15:11	0.030
	Day 3	**11/23/2016**	13:37	13:32	13:49	3.7	5.2	13:22	0.043
Week 8	**Day 1**	**11/28/2016**	9:30	9:55	9:34	3.5	8.4	10:20	0.027
	Day 2	**11/30/2016**	9:45	10:51	10:38	2.2	2.5	11:18	0.026
	Day 3	**12/2/2016**	13:54	14:20	14:21	1.9	2.0	14:39	0.023
Week 9	**Day 1**	**12/5/2016**	9:00	9:28	9:03	2.4	2.6	9:49	0.025
	Day 2	**12/7/2016**	9:34	10:06	10:08	2.5	2.7	10:26	0.029
	Day 3	**12/9/2016**	14:38	15:08	15:16	1.9	2.0	15:18	0.027
Week 10	**Day 1**	**12/12/2016**	9:57	10:39	10:45	2.8	3.0	10:54	0.028
	Day 2	**12/14/2016**	9:39	10:09	10:10	3.4	3.6	9:52	0.027
	Day 3	**12/16/2016**	14:53	15:15	15:20	2.4	4.2	15:26	0.033
Week 11	**Day 1**	**12/19/2016**	14:44	14:17	14:03	2.5	2.7	14:41	0.041
	Day 2	**12/20/2016**	9:11	9:31	9:30	2.8	3.0	9:42	0.030
	Day 3	**12/21/2016**	10:39	11:04	11:10	3.3	3.5	11:14	0.032
Week 12	**Day 1**	**12/27/2016**	14:42	15:10	15:08	3.8	5.0	15:37	0.036
	Day 2	**12/28/2016**	14:53	15:27	15:22	3.2	5.4	15:43	0.035
	Day 3	**12/29/2016**	14:49	15:16	15:20	3.0	3.2	15:30	0.030

Table A-4

Location D (Continued)

			Indoor									
			Aeroqual Sensor				IAQ Sensor					
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2	TA		RH
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%
Week 1	**Day 1**	**10/3/2016**	9:20	0.04	9:31	0.000	8:54	0	591	19.4	66.9	69.5
	Day 2	**10/5/2016**	14:20	0.02	14:37	0.000	14:02	0	870	23.6	74.5	43.5
	Day 3	**10/7/2016**	14:42	0.03	14:53	0.000	12:55	0	724	22.8	73.0	47.3
Week 2	**Day 1**	**10/10/2016**	9:03	0.02	9:21	0.000	8:51	0	516	16.5	61.7	66.7
	Day 2	**10/13/2016**	16:20	0.00	16:32	0.000	15:53	0	554	22.1	71.8	28.9
	Day 3	**10/14/2016**	16:14	0.01	16:26	0.000	16:37	0	851	23.2	73.8	37.9
Week 3	**Day 1**	**10/18/2016**	18:09	0.01	17:58	0.000	17:47	0	775	23.6	74.5	45.0
	Day 2	**10/20/2016**	14:58	0.00	15:09	0.000	14:39	0	541	20.5	68.9	41.7
	Day 3											
Week 4	**Day 1**	**11/1/2016**	14:42	0.00	14:18	0.000	14:37	0	538	23.6	74.5	25.4
	Day 2	**11/3/2016**	16:48	0.02	16:37	0.000	16:30	0	804	21.4	70.5	51.6
	Day 3	**11/4/2016**	13:18	0.00	13:30	0.000	13:00	0	660	22.2	72.0	42.0
Week 5	**Day 1**	**11/8/2016**	10:31	0.00	10:24	0.000	10:20	0	812	19.4	66.9	55.4
	Day 2	**11/9/2016**	7:18	0.00	7:07	0.000	7:02	0	544	18.0	64.4	42.6
	Day 3	**11/11/2016**	12:46	0.00	12:35	0.000	12:17	0	608	19.8	67.6	33.1
Week 6	**Day 1**	**11/14/2016**	16:49	0.00	16:39	0.000	16:45	0	681	22.7	72.9	32.6
	Day 2	**11/15/2016**	9:45	0.00	9:34	0.000	9:26	0	648	16.5	61.7	61.2
	Day 3	**11/18/2016**	9:24	0.00	8:47	0.000	8:40	0	525	19.1	66.4	54.7
Week 7	**Day 1**	**11/21/2016**	15:26	0.00	15:14	0.000	15:29	0	620	21.3	70.3	21.2
	Day 2	**11/22/2016**	14:21	0.00	13:58	0.000	15:29	0	659	21.7	71.1	26.4
	Day 3	**11/23/2016**	13:32	0.00	13:10	0.003	13:50	0	760	21.2	70.2	39.7
Week 8	**Day 1**	**11/28/2016**	9:59	0.00	9:41	0.000	10:01	0	664	21.2	70.2	36.4
	Day 2	**11/30/2016**	11:06	0.00	10:37	0.000	10:40	0	691	19.5	67.1	39.2
	Day 3	**12/2/2016**	14:20	0.00	14:01	0.000	14:22	0	1095	20.8	69.4	31.8
Week 9	**Day 1**	**12/5/2016**	9:36	0.00	9:02	0.000	9:50	0	667	21.4	70.5	28.6
	Day 2	**12/7/2016**	10:07	0.00	9:43	0.000	10:09	0	694	21.7	71.1	22.0
	Day 3	**12/9/2016**	15:05	0.00	14:51	0.000	15:14	0	692	22.5	72.5	14.6
Week 10	**Day 1**	**12/12/2016**	10:39	0.00	10:14	0.000	10:44	0	769	22.1	71.8	20.4
	Day 2	**12/14/2016**	10:28	0.00	10:08	0.000	10:09	0	678	20.8	69.4	16.1
	Day 3	**12/16/2016**	15:14	0.00	15:02	0.000	15:15	0	895	20.7	69.3	16.5
Week 11	**Day 1**	**12/19/2016**	14:18	0.00	14:06	0.000	14:19	0	1009	22.0	71.6	12.0
	Day 2	**12/20/2016**	9:23	0.00	9:19	0.000	9:43	0	612	20.0	68.0	15.7
	Day 3	**12/21/2016**	11:01	0.00	10:47	0.000	11:11	0	892	20.3	68.5	22.8
Week 12	**Day 1**	**12/27/2016**	15:05	0.00	14:54	0.000	15:07	0	683	20.8	69.4	21.2
	Day 2	**12/28/2016**	15:31	0.00	15:19	0.000	15:20	0	555	21.5	70.7	19.3
	Day 3	**12/29/2016**	15:19	0.00	14:55	0.000	15:20	0	728	20.8	69.4	21.7

Table A-4

Location D (Continued)

			Indoor				Outdoor				
			IAQ Sensor				Avg.	PM Meter			Aeroqu
		Date	DP		WB		Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time
			°C	°F	°C	°F	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm
Week 1	**Day 1**	**10/3/2016**	13.7	56.7	15.8	60.4	8:36	8:53	11.6	15.6	8:47
	Day 2	**10/5/2016**	10.8	51.4	15.8	60.4	13:43	14:00	18.4	19.2	13:44
	Day 3	**10/7/2016**	11.1	52.0	15.7	60.3	15:12	15:05	2.5	3.1	15:08
Week 2	**Day 1**	**10/10/2016**	10.4	50.7	12.9	55.2	8:27	8:17	6.7	7.7	8:46
	Day 2	**10/13/2016**	3.1	37.6	12.1	53.8	16:49	16:38	5.8	6.1	16:47
	Day 3	**10/14/2016**	8.2	46.8	14.5	58.1	16:30	15:55	8.9	10.5	16:42
Week 3	**Day 1**	**10/18/2016**	10.9	51.6	15.9	60.6	18:38	18:25	4.0	4.3	18:35
	Day 2	**10/20/2016**	7.2	45.0	12.9	55.2	15:17	15:15	5.2	9.0	15:23
	Day 3										
Week 4	**Day 1**	**11/1/2016**	2.7	36.9	12.6	54.7	15:02	14:50	3.4	3.6	15:10
	Day 2	**11/3/2016**	11.1	52.0	15.1	59.2	17:14	17:03	6.0	8.2	17:22
	Day 3	**11/4/2016**	8.7	47.7	14.3	57.7	12:37	12:25	3.6	3.8	12:34
Week 5	**Day 1**	**11/8/2016**	10.3	50.5	14.0	57.2	10:01	9:53	13.2	19.9	10:14
	Day 2	**11/9/2016**	5.3	41.5	11.1	52.0	7:47	7:37	3.8	4.6	8:05
	Day 3	**11/11/2016**	3.4	38.1	11.2	52.2	13:15	13:03	2.9	3.1	13:34
Week 6	**Day 1**	**11/14/2016**	5.4	41.7	13.2	55.8	8:04	6:04	10.7	19.6	5:36
	Day 2	**11/15/2016**	9.2	48.6	12.3	54.1	9:00	8:48	13.2	18.9	9:08
	Day 3	**11/18/2016**	9.8	49.6	13.6	56.5	8:08	7:56	18.1	27.2	8:17
Week 7	**Day 1**	**11/21/2016**	-1.7	28.9	10.3	50.5	14:07	13:53	3.0	3.2	14:23
	Day 2	**11/22/2016**	1.5	34.7	11.4	52.5	13:23	13:14	4.0	4.3	13:41
	Day 3	**11/23/2016**	7.2	45.0	13.3	55.9	13:43	13:03	12.3	16.0	14:21
Week 8	**Day 1**	**11/28/2016**	5.8	42.4	12.8	55.0	9:06	8:53	12.8	21.0	9:23
	Day 2	**11/30/2016**	4.9	40.8	11.7	53.1	8:38	8:37	7.5	9.4	9:01
	Day 3	**12/2/2016**	3.3	37.9	11.6	52.9	13:27	13:16	4.6	4.9	13:46
Week 9	**Day 1**	**12/5/2016**	2.4	36.3	11.6	52.9	8:33	8:31	10.1	17.6	8:43
	Day 2	**12/7/2016**	-0.7	30.7	10.7	51.3	9:01	8:50	2.0	2.4	9:17
	Day 3	**12/9/2016**	-5.7	21.7	9.8	49.6	14:08	13:58	3.4	3.6	14:26
Week 10	**Day 1**	**12/12/2016**	-1.9	28.6	10.6	51.1	9:16	9:13	12.3	26.4	9:22
	Day 2	**12/14/2016**	-6.2	20.8	9.1	48.4	9:09	9:05	6.8	10.8	9:25
	Day 3	**12/16/2016**	-5.7	21.7	9.1	48.4	14:31	14:20	5.8	8.3	14:35
Week 11	**Day 1**	**12/19/2016**	-8.2	17.2	9.1	48.4	15:11	15:03	6.0	6.4	15:15
	Day 2	**12/20/2016**	-6.7	19.9	8.6	47.5	8:51	8:50	7.3	7.7	9:06
	Day 3	**12/21/2016**	-1.5	29.3	9.9	49.8	10:13	10:10	17.7	33.0	10:16
Week 12	**Day 1**	**12/27/2016**	-2.3	27.9	10.0	50.0	14:14	14:16	6.4	7.2	14:05
	Day 2	**12/28/2016**	-3.0	26.6	10.1	50.2	14:19	14:14	7.9	10.7	14:34
	Day 3	**12/29/2016**	-1.7	28.9	10.0	50.0	14:21	14:12	8.2	8.7	14:38

Table A-4

Location D (Continued)

			Outdoor									
			Aeroqual Sensor					IAQ Sensor				
		Date	NO_2	Time	SO_2	Time	O_3	Time	CO	CO_2	TA	
			ppm	hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F
Week 1	**Day 1**	**10/3/2016**	0.027	8:25	0.00	8:35	0.000	8:21	0	464	14.6	58.3
	Day 2	**10/5/2016**	0.007	13:31	0.03	13:55	0.007	13:25	0	424	23.4	74.1
	Day 3	**10/7/2016**	0.057	15:30	0.00	15:19	0.008	15:01	0	414	20.5	68.9
Week 2	**Day 1**	**10/10/2016**	0.038	8:24	0.00	8:35	0.000	8:15	0	453	14.2	57.6
	Day 2	**10/13/2016**	0.022	16:58	0.00	17:09	0.000	16:37	0	419	17.5	63.5
	Day 3	**10/14/2016**	0.045	16:55	0.00	17:05	0.024	15:56	0	429	17.4	63.3
Week 3	**Day 1**	**10/18/2016**	0.051	18:46	0.00	18:58	0.004	18:26	0	422	20.1	68.2
	Day 2	**10/20/2016**	0.040					15:14	0	434	15.9	60.6
	Day 3											
Week 4	**Day 1**	**11/1/2016**	0.051	15:21	0.00	14:59	0.031	14:50	0	431	14.8	58.6
	Day 2	**11/3/2016**	0.055	17:33	0.00	17:11	0.016	17:04	0	448	15.1	59.2
	Day 3	**11/4/2016**	0.050	12:56	0.00	12:45	0.012	12:27	0	428	15.5	59.9
Week 5	**Day 1**	**11/8/2016**	0.032	10:07	0.01	10:00	0.011	9:55	0	433	15.3	59.5
	Day 2	**11/9/2016**	0.054	7:54	0.00	7:44	0.000	7:35	0	448	8.8	47.8
	Day 3	**11/11/2016**	0.048	13:23	0.00	13:13	0.019	13:04	0	430	14.6	58.3
Week 6	**Day 1**	**11/14/2016**	0.048	5:25	0.00	5:14	0.000	18:05	0	475	17.4	63.3
	Day 2	**11/15/2016**	0.032	9:19	0.00	8:58	0.002	8:49	0	438	9.7	49.5
	Day 3	**11/18/2016**	0.038	8:28	0.00	8:06	0.032	7:57	0	396	16.2	61.2
Week 7	**Day 1**	**11/21/2016**	0.045	14:12	0.00	14:01	0.041	14:10	0	407	11.0	51.8
	Day 2	**11/22/2016**	0.045	13:31	0.00	13:20	0.051	13:10	0	391	5.8	42.4
	Day 3	**11/23/2016**	0.020	14:10	0.00	13:58	0.000	13:03	0	406	7.7	82.6
Week 8	**Day 1**	**11/28/2016**	0.043	9:12	0.00	9:02	0.019	9:00	0	391	7.2	45.0
	Day 2	**11/30/2016**	0.025	8:50	0.00	8:03	0.000	8:40	0	400	6.2	43.2
	Day 3	**12/2/2016**	0.037	13:35	0.00	13:24	0.021	13:18	0	402	2.8	37.0
Week 9	**Day 1**	**12/5/2016**	0.041	8:38	0.00	8:27	0.008	8:30	0	405	2.1	35.8
	Day 2	**12/7/2016**	0.039	9:06	0.00	8:56	0.000	8:58	0	404	-4.3	24.3
	Day 3	**12/9/2016**	0.048	14:15	0.00	14:05	0.032	13:59	0	389	-1.0	30.2
Week 10	**Day 1**	**12/12/2016**	0.040	9:34	0.00	9:11	0.002	9:00	0	400	-3.2	26.2
	Day 2	**12/14/2016**	0.038	9:14	0.00	9:03	0.000	9:00	0	403	-6.6	20.1
	Day 3	**12/16/2016**	0.044	14:47	0.00	14:24	0.027		0	394	-6.5	20.3
Week 11	**Day 1**	**12/19/2016**	0.059	15:26	0.00	15:05	0.036	15:10	0	404	-8.7	16.3
	Day 2	**12/20/2016**	0.047	8:55	0.00	8:45	0.000	8:41	0	399	-4.6	23.7
	Day 3	**12/21/2016**	0.044	10:27	0.00	10:06	0.000	10:08	0	436	-0.5	31.1
Week 12	**Day 1**	**12/27/2016**	0.044	14:15	0.00	14:26	0.032	14:09	0	388	-2.6	27.3
	Day 2	**12/28/2016**	0.040	14:23	0.00	14:12	0.026	14:16	0	380	6.6	43.9
	Day 3	**12/29/2016**	0.037	14:27	0.00	14:16	0.020	14:13	0	382	0.9	33.6

Table A-4

Location D (Continued)

			Outdoor				
			IAQ Sensor				
		Date	RH	DP		WB	
			%	°C	°F	°C	°F
Week 1	**Day 1**	**10/3/2016**	89.9	12.8	55.0	13.5	56.3
	Day 2	**10/5/2016**	68.9	17.7	63.9	19.5	67.1
	Day 3	**10/7/2016**	45.7	8.6	47.5	13.6	56.5
Week 2	**Day 1**	**10/10/2016**	71.6	9.0	48.2	11.3	52.3
	Day 2	**10/13/2016**	33.4	0.5	32.9	8.8	47.8
	Day 3	**10/14/2016**	60.0	9.7	49.5	13.0	55.4
Week 3	**Day 1**	**10/18/2016**	44.8	7.3	45.1	13.1	55.6
	Day 2	**10/20/2016**	43.8	3.6	38.5	9.9	49.8
	Day 3						
Week 4	**Day 1**	**11/1/2016**	36.4	1.2	34.2	8.6	47.5
	Day 2	**11/3/2016**	63.8	7.9	46.2	11.2	52.2
	Day 3	**11/4/2016**	54.4	6.6	43.9	10.6	51.1
Week 5	**Day 1**	**11/8/2016**	63.2	7.7	45.9	11.4	52.5
	Day 2	**11/9/2016**	55.5	-0.2	31.6	5.0	41.0
	Day 3	**11/11/2016**	36.1	-0.3	31.5	7.7	45.9
Week 6	**Day 1**	**11/14/2016**	44.4	5.1	41.2	10.9	51.6
	Day 2	**11/15/2016**	86.4	7.4	45.3	8.4	47.1
	Day 3	**11/18/2016**	59.6	8.2	46.8	11.8	53.2
Week 7	**Day 1**	**11/21/2016**	30.8	-7.3	18.9	3.1	37.6
	Day 2	**11/22/2016**	71.3	0.8	33.4	3.6	38.5
	Day 3	**11/23/2016**	82.6	5.4	41.7	6.9	44.4
Week 8	**Day 1**	**11/28/2016**	90.1	5.6	42.1	6.4	43.5
	Day 2	**11/30/2016**	63.0	-1.2	29.8	3.0	37.4
	Day 3	**12/2/2016**	59.4	-4.6	23.7	0.1	32.2
Week 9	**Day 1**	**12/5/2016**	85.1	-0.1	31.8	1.2	34.2
	Day 2	**12/7/2016**	67.8	-9.3	15.3	-5.8	21.6
	Day 3	**12/9/2016**	37.1	-13.6	7.5	-4.4	24.1
Week 10	**Day 1**	**12/12/2016**	61.2	-10.2	13.6	-5.1	22.8
	Day 2	**12/14/2016**	49.4	-15.4	4.3	E02	E02
	Day 3	**12/16/2016**	51.4	-14.4	6.1	E02	E02
Week 11	**Day 1**	**12/19/2016**	39.4	-20.9	-5.6	E02	E02
	Day 2	**12/20/2016**	54.2	-12.4	9.7	-6.6	20.1
	Day 3	**12/21/2016**	69.5	-5.3	22.5	-2.3	27.9
Week 12	**Day 1**	**12/27/2016**	60.1	-9.3	15.3	-4.4	24.1
	Day 2	**12/28/2016**	46.3	-4.2	24.4	2.3	36.1
	Day 3	**12/29/2016**	65.9	-4.7	23.5	-1.2	29.8

Table A-4

Location D (Continued)

		Date	
			Weather; Notes
Week 1	**Day 1**	**10/3/2016**	Clear, no wind; construction next door to site, building up frame and shell
	Day 2	**10/5/2016**	Partially cloudy, but sunny
	Day 3	**10/7/2016**	Sunny, partial cloud, steady breeze; construction done for the day
Week 2	**Day 1**	**10/10/2016**	Welding at construction site next door, clear, little wind
	Day 2	**10/13/2016**	Clear, calm
	Day 3	**10/14/2016**	Clear, steady wind
Week 3	**Day 1**	**10/18/2016**	Clear, slight wind
	Day 2	**10/20/2016**	Overcast, some wind; constrcution next door
	Day 3		
Week 4	**Day 1**	**11/1/2016**	Clear, sunny, regular wind; during construction hours
	Day 2	**11/3/2016**	Clear, slight wind
	Day 3	**11/4/2016**	Clear, regular wind, construction next door
Week 5	**Day 1**	**11/8/2016**	Cirrus, cumulonimbus, few clouds, windy, construction next door (building out interior)
	Day 2	**11/9/2016**	A few cirrus clouds, little wind
	Day 3	**11/11/2016**	Cumulus (60%), little wind
Week 6	**Day 1**	**11/14/2016**	Cirrus (40%), no wind
	Day 2	**11/15/2016**	Overcast, little wind
	Day 3	**11/18/2016**	Cirrus (60%), gusty
Week 7	**Day 1**	**11/21/2016**	Clear, little wind
	Day 2	**11/22/2016**	Overcast, some wind
	Day 3	**11/23/2016**	Overcast, break in rain, little wind
Week 8	**Day 1**	**11/28/2016**	Overcast, some wind, construction next door
	Day 2	**11/30/2016**	Clear, little wind, construction next door
	Day 3	**12/2/2016**	Overcast, little wind
Week 9	**Day 1**	**12/5/2016**	Overcast, little wind
	Day 2	**12/7/2016**	50% cirrus, steady wind
	Day 3	**12/9/2016**	5% cumulus, little wind, construction next door and across river
Week 10	**Day 1**	**12/12/2016**	30% cumulus some wind, snow from weekend on ground
	Day 2	**12/14/2016**	50% cumulus, little wind, construction next door and across river
	Day 3	**12/16/2016**	Overcast, little wind, construction across river and next door
Week 11	**Day 1**	**12/19/2016**	Clear, some wind, no exterior construction next door
	Day 2	**12/20/2016**	40% cirrus, gusty winds, construction next door and across river
	Day 3	**12/21/2016**	Overcast, little wind, construction across river and next door
Week 12	**Day 1**	**12/27/2016**	Some wind, 95% cumulus, little snow, little river ice, constr. next door, across river, & inside
	Day 2	**12/28/2016**	Overcast, gusty, construction inside, next door, & across river; many ppl gone for holidays
	Day 3	**12/29/2016**	Overcast, gusty, construction inside, next door, & across river; many ppl gone for holidays

Table A-5

Location E

				Indoor						
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor		
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2	Time
			hh:mm	hh:mm	hh:mm	$\mu g/m^3$	$\mu g/m^3$	hh:mm	ppm	hh:mm
Week 1	**Day 1**	**10/4/2016**	8:39	8:22	8:10	9.3	9.8	8:41	0.013	8:30
	Day 2	**10/5/2016**	12:31	12:15	12:04	10.6	11.2	12:12	0.025	12:23
	Day 3	**10/6/2016**	9:38	10:00	8:27	9.8	10.3	15:36	0.023	8:35
Week 2	**Day 1**	**10/11/2016**	8:31	8:14	8:03	3.8	4.0	8:12	0.013	8:34
	Day 2	**10/12/2016**	13:03	12:46	12:37	13.5	14.2	12:54	0.025	12:43
	Day 3	**10/13/2016**	8:33	8:16	8:04	2.1	5.6	8:35	0.008	8:24
Week 3	**Day 1**	**10/18/2016**	8:48	8:31	8:19	5.6	5.9	8:28	0.024	8:39
	Day 2	**10/21/2016**	8:21	8:04	7:52	1.8	1.9	8:12	0.003	8:23
	Day 3									
Week 4	**Day 1**	**11/1/2016**	15:03	14:45	14:35	7.4	13.1	14:53	0.020	15:05
	Day 2	**11/2/2016**	10:38	10:20	10:08	4.9	6.7	10:17	0.018	10:29
	Day 3	**11/3/2016**	14:05	13:48	13:36	3.1	3.3	14:07	0.019	13:56
Week 5	**Day 1**	**11/7/2016**	11:40	11:24	11:12	4.2	4.5	11:43	0.022	11:31
	Day 2	**11/8/2016**	9:06	8:48	8:36	8.3	8.8	9:08	0.014	8:57
	Day 3	**11/9/2016**	10:20	10:03	9:51	2.9	4.1	10:22	0.030	10:11
Week 6	**Day 1**	**11/15/2016**	13:58	13:41	13:31	4.8	5.1	14:00	0.026	13:49
	Day 2	**11/16/2016**	11:02	10:45	10:34	6.3	8.1	11:04	0.014	10:53
	Day 3	**11/17/2016**	14:04	13:46	13:35	6.4	6.8	14:05	0.031	13:54
Week 7	**Day 1**	**11/21/2016**	11:25	11:07	10:56	2.5	2.7	11:24	0.020	11:13
	Day 2	**11/22/2016**	10:50	10:30	10:15	3.3	5.7	10:45	0.032	10:34
	Day 3	**11/23/2016**	10:34	10:19	10:03	4.7	6.2	10:34	0.023	10:23
Week 8	**Day 1**	**11/29/2016**	10:32	10:16	10:07	3.4	3.6	10:29	0.022	10:19
	Day 2	**12/1/2016**	10:22	10:07	9:54	2.7	3.9	10:19	0.013	10:08
	Day 3	**12/2/2016**	9:54	10:38	10:30	2.7	2.9	10:51	0.025	10:40
Week 9	**Day 1**	**12/6/2016**	10:32	10:19	10:14	4.1	4.4	10:25	0.018	10:14
	Day 2	**12/8/2016**	11:06	10:52	10:52	3.0	3.3	11:02	0.012	10:51
	Day 3	**12/9/2016**	11:34	11:17	11:01	2.4	2.6	11:33	0.026	11:21
Week 10	**Day 1**	**12/13/2016**	10:51	10:36	10:37	4.0	4.3	10:47	0.015	10:36
	Day 2	**12/15/2016**	10:20	10:10	10:08	2.8	3.0	10:22	0.031	10:10
	Day 3	**12/16/2016**	11:40	11:24	11:21	3.2	3.4	11:34	0.041	11:23
Week 11	**Day 1**	**12/20/2016**	10:34	10:18	10:19	3.8	4.5	10:29	0.038	10:18
	Day 2	**12/21/2016**	9:07	8:53	8:56	4.5	5.2	9:02	0.037	8:51
	Day 3	**12/22/2016**	11:31	11:15	11:04	3.3	3.5	11:29	0.038	11:18
Week 12	**Day 1**	**12/27/2016**	9:09	8:53	8:52	4.9	5.2	9:05	0.030	8:54
	Day 2	**12/28/2016**	8:19	8:02	7:55	9.5	50.2	8:15	0.030	8:04
	Day 3	**12/29/2016**	13:18	13:02	12:59	2.9	3.1	13:15	0.032	13:05

Table A-5

Location E (Continued)

			Indoor										
			Aeroqual Sensor			IAQ Sensor							
		Date	SO_2	Time	O_3	Time	CO	CO_2	TA		RH	DP	
			ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F	%	°C	°F
Week 1	**Day 1**	**10/4/2016**	0.03	8:19	0.000	8:11	0	647	20.3	68.5	67.5	14.0	57.2
	Day 2	**10/5/2016**	0.02	12:33	0.000	12:06	0	619	23.4	74.1	52.0	13.2	55.8
	Day 3	**10/6/2016**	0.00	8:57	0.000	8:29	0		20.9	69.6	62.0	13.4	56.1
Week 2	**Day 1**	**10/11/2016**	0.04	8:23	0.000	8:02	0	611	19.1	66.4	63.2	12.0	53.6
	Day 2	**10/12/2016**	0.00	13:05	0.000	12:35	0	526	21.4	70.5	57.4	12.6	54.7
	Day 3	**10/13/2016**	0.07	8:13	0.000	8:05	0	681	15.2	59.4	70.0	10.2	50.4
Week 3	**Day 1**	**10/18/2016**	0.01	8:50	0.000	8:20	0	529	22.2	72.0	58.4	13.6	56.5
	Day 2	**10/21/2016**	0.01	8:01	0.000	7:52	0	519	14.9	58.8	61.8	7.9	46.2
	Day 3												
Week 4	**Day 1**	**11/1/2016**	0.01	14:42	0.000	14:34	0	738	22.8	73.0	51.9	12.4	54.3
	Day 2	**11/2/2016**	0.02	10:40	0.000	10:09	0	728	23.2	73.8	50.5	12.4	54.3
	Day 3	**11/3/2016**	0.02	13:45	0.000	13:37	0	630	22.3	72.1	49.3	11.2	52.2
Week 5	**Day 1**	**11/7/2016**	0.02	11:21	0.000	11:13	0	642	23.0	73.4	43.4	9.9	49.8
	Day 2	**11/8/2016**	0.04	8:46	0.000	8:37	0	642	18.8	65.8	60.0	11.1	52.0
	Day 3	**11/9/2016**	0.00	10:01	0.000	9:50	0	561	15.9	60.6	52.2	6.3	43.3
Week 6	**Day 1**	**11/15/2016**	0.00	13:38	0.000	13:29	0	686	21.4	70.5	44.1	8.9	48.0
	Day 2	**11/16/2016**	0.01	10:43	0.000	10:33	0	635	19.1	66.4	51.0	8.8	47.8
	Day 3	**11/17/2016**	0.00	13:43	0.000	13:34	0	563	23.4	74.1	40.6	9.3	48.7
Week 7	**Day 1**	**11/21/2016**	0.03	11:01	0.000	11:03	0	787	20.2	68.4	26.3	0.2	32.4
	Day 2	**11/22/2016**	0.00	10:24	0.000	10:35	0	728	20.7	69.3	29.0	1.9	35.4
	Day 3	**11/23/2016**	0.00	10:12	0.000	10:24	0	476	20.1	68.2	38.8	5.7	42.3
Week 8	**Day 1**	**11/29/2016**	0.00	10:08	0.000	10:20	0	509	20.1	68.2	36.8	4.9	40.8
	Day 2	**12/1/2016**	0.01	9:57	0.000	10:17	0	520	20.9	69.6	32.5	3.8	38.8
	Day 3	**12/2/2016**	0.00	10:29	0.000	10:41	0	620	20.7	69.3	26.7	0.9	33.6
Week 9	**Day 1**	**12/6/2016**	0.04	10:30	0.000	10:16	0	705	21.1	70.0	32.9	4.1	39.4
	Day 2	**12/8/2016**	0.03	10:41	0.000	10:55	0	638	19.2	66.6	23.1	-2.3	27.9
	Day 3	**12/9/2016**	0.01	11:10	0.000	11:22	0	634	20.4	68.7	20.9	-2.7	27.1
Week 10	**Day 1**	**12/13/2016**	0.08	10:25	0.000	10:38	0	746	19.2	66.6	21.4	-2.9	26.8
	Day 2	**12/15/2016**	0.01	10:00	0.000		0	615	21.0	69.8	13.4	-8.2	17.2
	Day 3	**12/16/2016**	0.00	11:12	0.000	11:34	0	733	22.2	72.0	15.5	-4.5	23.9
Week 11	**Day 1**	**12/20/2016**	0.00	10:08	0.000	10:19	0	652	22.1	71.8	14.9	-6.1	21.0
	Day 2	**12/21/2016**	0.05	8:40	0.000	8:58	0	643	21.1	70.0	21.9	-1.7	28.9
	Day 3	**12/22/2016**	0.00	11:07	0.000	11:19	0	664	21.5	70.7	22.3	-0.8	30.6
Week 12	**Day 1**	**12/27/2016**	0.00	8:43	0.000	8:54	0	562	20.8	69.4	21.8	-1.6	29.1
	Day 2	**12/28/2016**	0.00	7:53	0.000	8:06	0	655	22.1	71.8	20.0	-1.4	29.5
	Day 3	**12/29/2016**	0.00	12:54	0.000	13:01	0	620	20.9	69.6	20.7	-2.3	27.9

Table A-5

Location E (Continued)

			Indoor		Outdoor					
			IAQ Sens		Avg.	PM Meter			Aeroqual Sens	
		Date	WB		Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			°C	°F	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm	ppm
Week 1	**Day 1**	**10/4/2016**	16.3	61.3	8:56	8:45	22.2	25.5	8:52	0.036
	Day 2	**10/5/2016**	16.9	62.4	12:47	12:37	19.6	21.7	12:41	0.018
	Day 3	**10/6/2016**	16.2	61.2	9:15	9:01	16.8	22.0	9:22	0.041
Week 2	**Day 1**	**10/11/2016**	14.9	58.8	8:49	8:37	6.5	7.5	8:46	0.053
	Day 2	**10/12/2016**	15.9	60.6	13:19	13:06	14.0	21.1	13:28	0.040
	Day 3	**10/13/2016**	12.2	54.0	8:51	8:40	3.6	7.0	9:09	0.060
Week 3	**Day 1**	**10/18/2016**	16.8	62.2	9:05	8:53	12.3	18.1	9:25	0.035
	Day 2	**10/21/2016**	11.0	51.8	8:38	8:26	2.9	3.2	8:46	0.062
	Day 3									
Week 4	**Day 1**	**11/1/2016**	16.3	61.3	15:21	15:16	9.0	12.0	15:27	0.051
	Day 2	**11/2/2016**	16.5	61.7	10:55	10:46	9.1	12.4	11:03	0.060
	Day 3	**11/3/2016**	15.5	59.9	14:21	14:11	7.7	11.8	14:40	0.047
Week 5	**Day 1**	**11/7/2016**	15.2	59.4	11:57	11:46	7.6	10.2	12:05	0.065
	Day 2	**11/8/2016**	14.3	57.7	9:23	9:12	16.5	23.3	9:41	0.042
	Day 3	**11/9/2016**	10.6	51.1	10:37	10:26	3.1	3.3	10:55	0.056
Week 6	**Day 1**	**11/15/2016**	14.1	57.4	14:16	14:03	16.9	19.0	14:35	0.043
	Day 2	**11/16/2016**	13.1	55.6	11:18	11:08	16.6	23.7	11:37	0.043
	Day 3	**11/17/2016**	15.1	59.2	14:23	14:08	11.8	17.3	14:30	0.054
Week 7	**Day 1**	**11/21/2016**	10.3	50.5	11:43	11:29	3.3	3.6	11:59	0.067
	Day 2	**11/22/2016**	11.1	52.0	11:09	11:10	3.0	3.2	11:09	0.027
	Day 3	**11/23/2016**	12.2	54.0	10:49	10:38	12.0	13.7	10:55	0.060
Week 8	**Day 1**	**11/29/2016**	11.8	53.2	10:48	10:34	5.4	7.6	11:05	0.052
	Day 2	**12/1/2016**	11.9	53.4	10:37	10:22	4.7	4.9	10:53	0.047
	Day 3	**12/2/2016**	10.7	51.3	9:09	11:02	3.0	5.0	1:13	0.065
Week 9	**Day 1**	**12/6/2016**	12.0	53.6	10:45	10:38	19.5	29.2	10:58	0.000
	Day 2	**12/8/2016**	8.9	48.0	11:21	11:15	4.9	5.2	11:36	0.068
	Day 3	**12/9/2016**	9.6	49.3	11:52	11:42	3.0	3.2	12:07	0.049
Week 10	**Day 1**	**12/13/2016**	8.9	48.0	11:07	10:56	8.3	19.3	11:00	0.066
	Day 2	**12/15/2016**	8.7	47.7	10:30	10:23	3.5	4.1	10:27	0.141
	Day 3	**12/16/2016**	9.9	49.8	11:56	11:50	5.2	10.3	12:00	0.054
Week 11	**Day 1**	**12/20/2016**	9.6	49.3	10:50	10:45	7.5	9.3	10:41	0.060
	Day 2	**12/21/2016**	10.0	50.0	9:21	9:16	16.3	25.5	9:14	0.062
	Day 3	**12/22/2016**	10.6	51.1	11:47	11:39	10.7	12.6	11:41	0.060
Week 12	**Day 1**	**12/27/2016**	10.1	50.2	9:24	9:18	4.6	5.1	9:16	0.058
	Day 2	**12/28/2016**	10.6	51.1	8:36	8:40	13.5	21.8	8:27	0.060
	Day 3	**12/29/2016**	9.9	49.8	13:34	13:23	5.9	6.2	13:50	0.049

Table A-5

Location E (Continued)

			Outdoor								
			Aeroqual Sensor				IAQ Sensor				
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2	TA	
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C	°F
Week 1	**Day 1**	**10/4/2016**	9:03	0.00	9:16	0.007	8:47	0	436	18.2	64.8
	Day 2	**10/5/2016**	13:06	0.02	12:53	0.005	12:39	0	424	23.1	73.6
	Day 3	**10/6/2016**	9:44	0.00	9:10	0.020	9:02	0	430	19.0	66.2
Week 2	**Day 1**	**10/11/2016**	8:57	0.00	9:08	0.008	8:37	0	455	18.2	64.8
	Day 2	**10/12/2016**	13:39	0.00	13:16	0.018	13:08	0	426	18.6	65.5
	Day 3	**10/13/2016**	8:59	0.00	8:48	0.002	8:39	0	447	8.0	46.4
Week 3	**Day 1**	**10/18/2016**	9:14	0.00	9:03	0.018	8:54	0	426	21.8	71.2
	Day 2	**10/21/2016**	8:56	0.00	8:36	0.004	8:27	0	428	6.7	44.1
	Day 3										
Week 4	**Day 1**	**11/1/2016**	15:16	0.00	15:38	0.027	15:09	0	425	22.6	72.7
	Day 2	**11/2/2016**	11:14	0.00	10:52	0.016	10:43	0	447	13.2	55.8
	Day 3	**11/3/2016**	14:30	0.00	14:19	0.009	14:09	0	450	19.1	66.4
Week 5	**Day 1**	**11/7/2016**	11:55	0.00	12:16	0.023	11:47	0	433	18.2	64.8
	Day 2	**11/8/2016**	9:30	0.00	9:20	0.015	9:13	0	436	12.8	55.0
	Day 3	**11/9/2016**	10:44	0.00	10:34	0.026	10:27	0	432	11.7	53.1
Week 6	**Day 1**	**11/15/2016**	14:24	0.00	14:13	0.007	14:06	0	438	11.9	53.4
	Day 2	**11/16/2016**	11:26	0.00	11:16	0.011	11:07	0	463	15.5	59.9
	Day 3	**11/17/2016**	14:51	0.00	14:19	0.029	14:09	0	420	22.1	71.8
Week 7	**Day 1**	**11/21/2016**	11:48	0.00	11:37	0.036	11:43	0	410	-0.4	31.3
	Day 2	**11/22/2016**	11:20	0.00	10:58	0.067	11:10	0	395	6.3	43.3
	Day 3	**11/23/2016**	11:06	0.00	10:45	0.016	10:42	0	400	8.4	47.1
Week 8	**Day 1**	**11/29/2016**	10:54	0.00	10:43	0.016	10:44	0	382	8.9	48.0
	Day 2	**12/1/2016**	10:42	0.00	10:31	0.001	10:40	0	397	5.1	41.2
	Day 3	**12/2/2016**	11:24	0.00	11:03	0.030	11:07	0	389	2.2	36.0
Week 9	**Day 1**	**12/6/2016**	10:47	0.00	10:37	0.000	10:46	0	395	6.4	43.5
	Day 2	**12/8/2016**	11:25	0.00	11:15	0.025	11:17	0	400	-5.2	22.6
	Day 3	**12/9/2016**	11:56	0.00	11:45	0.037	11:50	0	397	-4.4	24.1
Week 10	**Day 1**	**12/13/2016**	11:25	0.00	11:12	0.021	11:03	0	406	-12.1	10.2
	Day 2	**12/15/2016**	10:32	0.00	10:37	0.058	10:34	0	405	-16.3	2.7
	Day 3	**12/16/2016**	12:10	0.00	11:49	0.003	11:52	0	414	-5.3	22.5
Week 11	**Day 1**	**12/20/2016**	11:02	0.00	10:51	0.016	10:55	0	397	-2.6	27.3
	Day 2	**12/21/2016**	9:35	0.00	9:25	0.000	9:18	0	427	1.4	34.5
	Day 3	**12/22/2016**	12:03	0.00	11:52	0.026	11:43	0	398	1.4	34.5
Week 12	**Day 1**	**12/27/2016**	9:38	0.00	9:27	0.028	9:25	0	400	-4.1	24.6
	Day 2	**12/28/2016**	8:38	0.00	8:48	0.001	8:30	0	413	-1.6	29.1
	Day 3	**12/29/2016**	13:39	0.00	13:28	0.034	13:30	0	383	0.3	32.5

Table A-5

Location E (Continued)

			Outdoor				
			IAQ Sensor				
		Date	RH	DP		WB	
			%	°C	°F	°C	°F
Week 1	**Day 1**	**10/4/2016**	88.0	16.3	61.3	16.9	62.4
	Day 2	**10/5/2016**	70.4	17.1	62.8	19.1	66.4
	Day 3	**10/6/2016**	87.9	17.1	62.8		
Week 2	**Day 1**	**10/11/2016**	60.9	10.6	51.1	13.6	56.5
	Day 2	**10/12/2016**	76.9	14.4	57.9	15.9	60.6
	Day 3	**10/13/2016**	51.5	-1.2	29.8	3.9	39.0
Week 3	**Day 1**	**10/18/2016**	76.7	17.6	63.7	19.0	66.2
	Day 2	**10/21/2016**	62.2	-0.1	31.8	3.8	38.8
	Day 3						
Week 4	**Day 1**	**11/1/2016**	47.6	10.8	51.4	15.4	59.7
	Day 2	**11/2/2016**	82.5	11.1	52.0	11.9	53.4
	Day 3	**11/3/2016**	53.6	9.3	48.7	13.4	56.1
Week 5	**Day 1**	**11/7/2016**	42.7	5.2	41.4	11.2	52.2
	Day 2	**11/8/2016**	75.2	8.6	47.5	10.4	50.7
	Day 3	**11/9/2016**	52.2	-0.8	30.6	6.2	43.2
Week 6	**Day 1**	**11/15/2016**	64.7	4.9	40.8	8.5	47.3
	Day 2	**11/16/2016**	52.4	5.5	41.9	10.2	50.4
	Day 3	**11/17/2016**	43.5	9.2	48.6	14.5	58.1
Week 7	**Day 1**	**11/21/2016**	56.6	-8.0	17.6	-2.9	26.8
	Day 2	**11/22/2016**	61.6	-0.7	30.7	3.3	37.9
	Day 3	**11/23/2016**	70.2	4.5	40.1	6.1	43.0
Week 8	**Day 1**	**11/29/2016**	63.4	2.3	36.1	5.8	42.4
	Day 2	**12/1/2016**	77.3	1.4	34.5	3.5	38.3
	Day 3	**12/2/2016**	54.1	-6.2	20.8	-0.8	30.6
Week 9	**Day 1**	**12/6/2016**	68.3	1.2	34.2	4.1	39.4
	Day 2	**12/8/2016**	62.5	-11.2	11.8	-7.0	19.4
	Day 3	**12/9/2016**	53.4	-12.2	10.0	-6.7	19.9
Week 10	**Day 1**	**12/13/2016**	51.9	-20.3	-4.5	E02	E02
	Day 2	**12/15/2016**	57.7	E02	E02	E02	E02
	Day 3	**12/16/2016**	35.8	-18.3	-0.9	E02	E02
Week 11	**Day 1**	**12/20/2016**	57.9	-9.8	14.4	-4.8	23.4
	Day 2	**12/21/2016**	60.6	-5.5	22.1	-1.1	30.0
	Day 3	**12/22/2016**	64.0	-4.7	23.5	-0.9	30.4
Week 12	**Day 1**	**12/27/2016**	71.7	-8.3	17.1	-5.3	22.5
	Day 2	**12/28/2016**	81.4	-4.4	24.1	-2.6	27.3
	Day 3	**12/29/2016**	66.2	-5.2	22.6	-1.7	28.9

Table A-5

Location E (Continued)

		Date	
			Weather; Notes
Week 1	**Day 1**	**10/4/2016**	Overcast; can see AHU from OA test location (on roof location)
	Day 2	**10/5/2016**	Overcast, very lightly sprinkling, slight gusts
	Day 3	**10/6/2016**	Overcast, steady wind, light sprinkling
Week 2	**Day 1**	**10/11/2016**	Overcast, light breeze
	Day 2	**10/12/2016**	Overcast with steady wind
	Day 3	**10/13/2016**	Clear, calm
Week 3	**Day 1**	**10/18/2016**	Very windy, partially cloudy, train for NO2
	Day 2	**10/21/2016**	Clear, steady wind
	Day 3		
Week 4	**Day 1**	**11/1/2016**	Some cirrus clouds, slight wind
	Day 2	**11/2/2016**	Sprinkling, train
	Day 3	**11/3/2016**	Mostly clear, mackeral sky, some wind
Week 5	**Day 1**	**11/7/2016**	Clear, some wind
	Day 2	**11/8/2016**	Cirrus, cumulonimbus, partially cloudy, windy
	Day 3	**11/9/2016**	Clear, slight wind
Week 6	**Day 1**	**11/15/2016**	Cloudy (85%), cumulonimbus and cirrus, some wind, train for O3, train stopped for PM
	Day 2	**11/16/2016**	Overcast, little wind
	Day 3	**11/17/2016**	Cumulus (40%) and cirrus, slight gusts
Week 7	**Day 1**	**11/21/2016**	Clear, little wind
	Day 2	**11/22/2016**	Overcast-ish (top 100% cover, bottom 15% cover), little wind, train for SO2
	Day 3	**11/23/2016**	Overcast, light drizzle, some wind
Week 8	**Day 1**	**11/29/2016**	Clear, little wind
	Day 2	**12/1/2016**	Overcast, steady wind, train for NO2, SO2
	Day 3	**12/2/2016**	Overcast, steady wind, train for O3, PM
Week 9	**Day 1**	**12/6/2016**	95% cumulus, little wind
	Day 2	**12/8/2016**	40% cumulus, gusty, train
	Day 3	**12/9/2016**	40% cumulus, some wind
Week 10	**Day 1**	**12/13/2016**	Clear, some wind, snow on ground from weekend
	Day 2	**12/15/2016**	Clear, steady wind
	Day 3	**12/16/2016**	Overcast, little wind, snowed a dusting night prior
Week 11	**Day 1**	**12/20/2016**	Small gusts/little wind, snow from weekend, clear, train for SO2
	Day 2	**12/21/2016**	Overcast, little wind
	Day 3	**12/22/2016**	Clear, some wind, train for SO2 and NO2
Week 12	**Day 1**	**12/27/2016**	Overcast, some wind, snow gone, many people gone for holidays
	Day 2	**12/28/2016**	95% cumulus and cirrus, little wind, many employees gone on holiday
	Day 3	**12/29/2016**	Overcast, gusty; many people gone for holidays

Table A-6

Average

				Indoor					
			Avg. Total	Avg.	PM Meter			Aeroqual Sensor	
		Date	Time	Indoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2
			hh:mm	hh:mm	hh:mm	µg/m³	µg/m³	hh:mm	ppm
Week 1	**Day 1**	**10/3/2016**	8:05	7:52	7:36	5.0	5.4	7:58	0.012
	Day 2	**10/5/2016**	11:39	11:11	11:25	5.3	5.6	11:54	0.019
	Day 3	**10/6/2016**	9:26	9:14	8:55	4.7	4.9	10:26	0.013
Week 2	**Day 1**	**10/10/2016**	7:58	7:48	7:36	3.1	3.7	7:59	0.020
	Day 2	**10/12/2016**	13:11	12:53	12:41	4.5	4.8	13:01	0.018
	Day 3	**10/13/2016**	9:34	9:19	9:12	1.9	3.6	9:17	0.012
Week 3	**Day 1**	**10/18/2016**	13:15	12:57	12:45	2.8	3.0	13:02	0.023
	Day 2	**10/20/2016**	10:28	10:11	9:59	2.1	2.5	10:11	0.014
	Day 3	**10/21/2016**	6:58	6:40	6:30	1.0	1.1	6:37	0.015
Week 4	**Day 1**	**11/1/2016**	12:39	12:22	12:14	3.4	4.7	12:32	0.022
	Day 2	**11/2/2016**	11:53	11:35	11:24	2.9	4.7	11:45	0.020
	Day 3	**11/3/2016**	9:51	9:41	9:31	2.1	2.4	9:52	0.014
Week 5	**Day 1**	**11/8/2016**	10:50	10:38	10:27	3.3	4.4	10:56	0.024
	Day 2	**11/9/2016**	11:53	11:39	11:28	3.0	3.2	11:57	0.024
	Day 3	**11/10/2016**	9:20	9:02	8:50	1.7	3.0	9:21	0.024
Week 6	**Day 1**	**11/14/2016**	9:55	10:32	10:23	2.8	2.9	10:51	0.028
	Day 2	**11/15/2016**	10:00	9:49	9:39	4.2	5.2	10:08	0.018
	Day 3	**11/17/2016**	12:30	12:20	12:04	5.7	7.1	12:40	0.027
Week 7	**Day 1**	**11/21/2016**	11:22	11:16	11:07	1.9	2.1	11:33	0.025
	Day 2	**11/22/2016**	10:46	10:41	10:46	2.4	3.1	10:50	0.032
	Day 3	**11/23/2016**	10:25	10:11	10:10	3.2	4.6	10:19	0.030
Week 8	**Day 1**	**11/28/2016**	8:57	8:49	8:39	2.8	4.2	9:04	0.021
	Day 2	**11/30/2016**	8:49	8:49	8:38	2.1	2.5	9:04	0.022
	Day 3	**12/2/2016**	10:30	10:34	10:29	2.0	2.5	10:43	0.026
Week 9	**Day 1**	**12/5/2016**	8:44	8:37	8:13	2.9	3.2	8:49	0.020
	Day 2	**12/7/2016**	9:15	9:09	9:09	2.4	2.5	9:21	0.021
	Day 3	**12/9/2016**	11:21	11:14	11:12	2.0	2.6	11:26	0.019
Week 10	**Day 1**	**12/12/2016**	9:14	9:08	9:11	2.9	3.1	9:19	0.025
	Day 2	**12/14/2016**	8:59	8:55	8:55	2.5	2.7	8:55	0.028
	Day 3	**12/16/2016**	11:25	11:17	11:18	2.5	3.0	11:28	0.038
Week 11	**Day 1**	**12/19/2016**	9:56	9:37	9:32	2.8	3.1	9:51	0.036
	Day 2	**12/20/2016**	10:36	10:27	10:27	2.8	3.3	10:37	0.037
	Day 3	**12/21/2016**	10:48	10:40	10:37	3.1	3.3	10:51	0.033
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	10:56	3.2	3.6	11:13	0.032
	Day 2	**12/28/2016**	11:28	11:22	11:17	4.3	13.1	11:35	0.033
	Day 3	**12/29/2016**	11:11	11:04	11:02	2.3	2.5	11:17	0.029

Table A-6

Average (Continued)

			Indoor						
			Aeroqual Sensor				IAQ Sensor		
		Date	Time	SO_2	Time	O_3	Time	CO	CO_2
			hh:mm	ppm	hh:mm	ppm	hh:mm	ppm	ppm
Week 1	**Day 1**	**10/3/2016**	8:08	0.04	7:56	0.000	7:44	0	583
	Day 2	**10/5/2016**	9:13	0.04	11:52	0.000	11:34	0	673
	Day 3	**10/6/2016**	9:05	0.03	9:12	0.000	8:32	0	559
Week 2	**Day 1**	**10/10/2016**	7:53	0.02	7:58	0.000	7:35	0	602
	Day 2	**10/12/2016**	12:59	0.01	13:03	0.000	12:40	0	592
	Day 3	**10/13/2016**	9:24	0.04	9:30	0.000	9:13	0	668
Week 3	**Day 1**	**10/18/2016**	13:04	0.05	13:07	0.000	12:45	0	646
	Day 2	**10/20/2016**	10:21	0.00	10:25	0.000	10:00	0	611
	Day 3	**10/21/2016**	6:48	0.00	6:59	0.000	6:29	0	499
Week 4	**Day 1**	**11/1/2016**	12:34	0.01	12:16	0.000	12:14	0	634
	Day 2	**11/2/2016**	11:43	0.04	11:41	0.000	11:24	0	712
	Day 3	**11/3/2016**	9:50	0.01	9:41	0.000	9:31	0	644
Week 5	**Day 1**	**11/8/2016**	10:45	0.04	10:35	0.000	10:28	0	697
	Day 2	**11/9/2016**	11:46	0.01	11:35	0.000	11:29	0	613
	Day 3	**11/10/2016**	9:11	0.00	9:00	0.000	8:49	0	564
Week 6	**Day 1**	**11/14/2016**	10:39	0.01	10:28	0.000	10:22	0	606
	Day 2	**11/15/2016**	9:57	0.00	9:46	0.000	9:38	0	642
	Day 3	**11/17/2016**	12:38	0.00	12:13	0.000	12:04	0	697
Week 7	**Day 1**	**11/21/2016**	11:19	0.01	11:08	0.000	11:14	0	607
	Day 2	**11/22/2016**	10:35	0.00	10:22	0.000	10:50	0	620
	Day 3	**11/23/2016**	10:12	0.00	9:59	0.001	10:17	0	547
Week 8	**Day 1**	**11/28/2016**	8:52	0.00	8:39	0.000	8:53	0	512
	Day 2	**11/30/2016**	8:53	0.00	8:39	0.000	8:52	0	534
	Day 3	**12/2/2016**	10:35	0.01	10:27	0.000	10:36	0	650
Week 9	**Day 1**	**12/5/2016**	8:37	0.01	8:21	0.000	8:42	0	555
	Day 2	**12/7/2016**	9:09	0.01	8:56	0.000	9:12	0	618
	Day 3	**12/9/2016**	11:14	0.01	11:03	0.000	11:17	0	632
Week 10	**Day 1**	**12/12/2016**	9:08	0.02	8:54	0.000	9:10	0	679
	Day 2	**12/14/2016**	8:58	0.00	8:50	0.000	8:37	0	568
	Day 3	**12/16/2016**	11:16	0.00	11:05	0.000	11:19	0	698
Week 11	**Day 1**	**12/19/2016**	9:38	0.00	9:26	0.000	9:38	0	643
	Day 2	**12/20/2016**	10:25	0.01	10:16	0.000	10:30	0	629
	Day 3	**12/21/2016**	10:40	0.00	10:30	0.000	10:44	0	585
Week 12	**Day 1**	**12/27/2016**	10:58	0.01	10:47	0.000	10:59	0	526
	Day 2	**12/28/2016**	11:24	0.00	11:13	0.000	11:21	0	551
	Day 3	**12/29/2016**	11:06	0.00	10:52	0.000	11:06	0	558

Table A-6

Average (Continued)

			Indoor						
			IAQ Sensor						
		Date	TA		RH	DP		WB	
			°C	°F	%	°C	°F	°C	°F
Week 1	**Day 1**	**10/3/2016**	21.8	71.2	60.4	13.9	57.1	16.8	62.3
	Day 2	**10/5/2016**	22.6	72.7	54.7	13.0	55.4	16.6	61.9
	Day 3	**10/6/2016**	21.9	71.5	59.2	13.6	56.4	16.7	62.0
Week 2	**Day 1**	**10/10/2016**	20.1	68.1	56.1	11.0	51.9	14.7	58.5
	Day 2	**10/12/2016**	21.0	69.8	53.3	11.0	51.7	15.1	59.1
	Day 3	**10/13/2016**	20.9	69.6	39.6	6.6	43.9	12.9	55.3
Week 3	**Day 1**	**10/18/2016**	23.5	74.3	50.6	12.3	54.2	16.6	61.9
	Day 2	**10/20/2016**	20.4	68.8	46.6	8.5	47.3	13.6	56.4
	Day 3	**10/21/2016**	19.4	66.9	38.8	4.7	40.5	11.6	52.9
Week 4	**Day 1**	**11/1/2016**	22.4	72.2	46.0	9.7	49.4	15.0	58.9
	Day 2	**11/2/2016**	21.4	70.6	52.7	11.3	52.3	15.3	59.6
	Day 3	**11/3/2016**	20.7	69.2	47.4	9.0	48.3	13.9	57.0
Week 5	**Day 1**	**11/8/2016**	21.6	70.9	42.9	8.2	46.7	14.0	57.1
	Day 2	**11/9/2016**	22.2	72.0	29.9	3.7	38.7	12.4	54.3
	Day 3	**11/10/2016**	19.9	67.9	35.0	4.0	39.1	11.5	52.6
Week 6	**Day 1**	**11/14/2016**	20.9	69.7	38.6	5.9	42.7	12.7	54.9
	Day 2	**11/15/2016**	20.1	68.2	46.6	8.3	46.9	13.4	56.0
	Day 3	**11/17/2016**	21.9	71.4	46.7	10.0	50.0	14.8	58.7
Week 7	**Day 1**	**11/21/2016**	21.3	70.3	20.5	-2.5	27.5	10.0	50.1
	Day 2	**11/22/2016**	21.6	70.9	24.4	0.2	32.3	10.9	51.7
	Day 3	**11/23/2016**	21.5	70.6	36.0	5.8	42.4	12.8	55.0
Week 8	**Day 1**	**11/28/2016**	21.5	70.7	34.6	5.2	41.3	12.6	54.6
	Day 2	**11/30/2016**	21.4	70.5	31.5	3.6	38.4	12.0	53.5
	Day 3	**12/2/2016**	21.4	70.5	26.7	1.2	34.1	11.1	52.1
Week 9	**Day 1**	**12/5/2016**	21.7	71.1	28.7	2.7	36.8	11.8	53.2
	Day 2	**12/7/2016**	21.0	69.8	20.4	-2.8	26.9	9.8	49.7
	Day 3	**12/9/2016**	21.3	70.4	18.5	-4.0	24.9	9.7	49.5
Week 10	**Day 1**	**12/12/2016**	21.3	70.3	19.0	-3.6	25.6	9.8	49.6
	Day 2	**12/14/2016**	21.2	70.2	12.8	-8.8	16.2	8.8	47.8
	Day 3	**12/16/2016**	21.0	69.8	16.2	-5.6	22.0	9.2	48.5
Week 11	**Day 1**	**12/19/2016**	21.1	70.0	13.6	-8.2	17.2	8.8	47.8
	Day 2	**12/20/2016**	21.3	70.4	19.2	-3.3	26.1	9.9	49.8
	Day 3	**12/21/2016**	21.4	70.5	22.4	-0.9	30.3	10.5	50.9
Week 12	**Day 1**	**12/27/2016**	21.5	70.6	19.9	-2.5	27.5	10.2	50.4
	Day 2	**12/28/2016**	21.8	71.2	21.1	-1.5	29.3	10.5	50.9
	Day 3	**12/29/2016**	21.3	70.3	22.0	-1.4	29.4	10.4	50.6

Table A-6

Average (Continued)

			Outdoor						
			Avg.	PM Meter			Aeroqual Sensor		
		Date	Outdoor T	Time	$PM_{2.5}$	PM_{10}	Time	NO_2	Time
			hh:mm	hh:mm	$\mu g/m^3$	$\mu g/m^3$	hh:mm	ppm	hh:mm
Week 1	**Day 1**	**10/3/2016**	8:17	8:11	15.3	18.2	8:22	0.040	8:18
	Day 2	**10/5/2016**	12:06	12:02	16.8	18.8	12:07	0.029	12:07
	Day 3	**10/6/2016**	9:37	9:27	12.9	16.1	9:39	0.047	9:50
Week 2	**Day 1**	**10/10/2016**	8:08	7:57	7.8	10.7	8:14	0.055	8:16
	Day 2	**10/12/2016**	13:29	13:18	6.9	8.6	13:30	0.044	13:39
	Day 3	**10/13/2016**	9:49	9:34	6.5	9.3	9:55	0.067	9:58
Week 3	**Day 1**	**10/18/2016**	13:33	13:20	6.5	8.6	13:38	0.045	13:38
	Day 2	**10/20/2016**	10:45	10:35	5.8	7.6	10:46	0.055	9:48
	Day 3	**10/21/2016**	7:16	7:04	2.2	2.4	7:13	0.069	7:23
Week 4	**Day 1**	**11/1/2016**	12:56	12:47	7.6	9.9	13:01	0.050	13:03
	Day 2	**11/2/2016**	12:10	12:00	8.9	11.3	12:20	0.052	12:22
	Day 3	**11/3/2016**	10:02	9:50	6.8	9.4	10:13	0.057	10:13
Week 5	**Day 1**	**11/8/2016**	11:02	10:51	9.7	14.4	11:17	0.050	11:07
	Day 2	**11/9/2016**	12:07	12:04	5.9	9.0	12:18	0.049	12:11
	Day 3	**11/10/2016**	9:39	9:29	4.0	4.7	9:50	0.050	9:50
Week 6	**Day 1**	**11/14/2016**	9:17	8:44	10.6	16.3	9:00	0.051	8:53
	Day 2	**11/15/2016**	10:10	9:59	16.0	23.0	10:26	0.044	10:19
	Day 3	**11/17/2016**	12:40	12:42	15.8	23.3	12:43	0.045	12:52
Week 7	**Day 1**	**11/21/2016**	11:27	11:14	3.4	3.6	11:40	0.064	11:37
	Day 2	**11/22/2016**	10:52	10:50	4.6	6.2	11:02	0.054	10:55
	Day 3	**11/23/2016**	10:39	10:25	11.7	15.0	10:52	0.050	10:54
Week 8	**Day 1**	**11/28/2016**	9:05	8:51	7.7	10.4	9:21	0.059	9:10
	Day 2	**11/30/2016**	8:50	8:36	5.8	7.3	9:05	0.047	8:54
	Day 3	**12/2/2016**	10:26	10:41	3.9	4.5	9:03	0.055	10:56
Week 9	**Day 1**	**12/5/2016**	8:52	8:47	14.3	21.4	9:03	0.046	8:54
	Day 2	**12/7/2016**	9:20	9:15	4.5	5.5	9:36	0.055	9:25
	Day 3	**12/9/2016**	11:29	11:20	3.1	3.5	11:43	0.058	11:32
Week 10	**Day 1**	**12/12/2016**	9:19	9:15	10.5	17.5	9:43	0.051	9:27
	Day 2	**12/14/2016**	9:03	8:58	5.1	7.6	8:59	0.044	9:07
	Day 3	**12/16/2016**	11:33	11:28	6.7	12.2	11:36	0.062	11:46
Week 11	**Day 1**	**12/19/2016**	10:15	10:09	6.9	8.5	10:18	0.068	10:21
	Day 2	**12/20/2016**	10:45	10:38	11.2	15.3	10:46	0.057	10:56
	Day 3	**12/21/2016**	10:55	10:48	11.8	16.7	10:51	0.055	11:08
Week 12	**Day 1**	**12/27/2016**	11:12	11:06	5.9	6.9	11:16	0.051	11:17
	Day 2	**12/28/2016**	11:34	11:30	9.3	14.2	11:40	0.048	11:37
	Day 3	**12/29/2016**	11:18	11:11	5.2	5.5	11:28	0.048	11:25

Table A-6

Average (Continued)

			Outdoor						
			Aeroqual Sensor			IAQ Sensor			
		Date	SO_2	Time	O_3	Time	CO	CO_2	TA
			ppm	hh:mm	ppm	hh:mm	ppm	ppm	°C
Week 1	**Day 1**	**10/3/2016**	0.00	8:27	0.002	8:07	0	449	16.2
	Day 2	**10/5/2016**	0.01	12:21	0.008	11:54	0	430	21.6
	Day 3	**10/6/2016**	0.00	9:43	0.019	9:26	0	431	19.4
Week 2	**Day 1**	**10/10/2016**	0.00	8:18	0.002	7:56	0	475	15.2
	Day 2	**10/12/2016**	0.00	13:41	0.005	13:18	0	428	13.9
	Day 3	**10/13/2016**	0.00	10:06	0.005	9:33	0	475	10.9
Week 3	**Day 1**	**10/18/2016**	0.00	13:45	0.017	13:21	0	404	22.2
	Day 2	**10/20/2016**	0.00	9:50	0.013	10:36	0	430	11.5
	Day 3	**10/21/2016**	0.00	7:34	0.000	7:07	0	433	7.2
Week 4	**Day 1**	**11/1/2016**	0.00	13:05	0.019	12:45	0	458	17.1
	Day 2	**11/2/2016**	0.01	12:11	0.008	11:59	0	467	14.6
	Day 3	**11/3/2016**	0.00	10:01	0.004	9:50	0	466	13.4
Week 5	**Day 1**	**11/8/2016**	0.00	11:03	0.016	10:51	0	435	14.1
	Day 2	**11/9/2016**	0.00	11:58	0.013	12:03	0	429	15.8
	Day 3	**11/10/2016**	0.00	9:37	0.022	9:27	0	433	11.1
Week 6	**Day 1**	**11/14/2016**	0.00	8:40	0.004	11:09	0	454	11.9
	Day 2	**11/15/2016**	0.00	10:07	0.006	10:01	0	448	12.0
	Day 3	**11/17/2016**	0.00	12:37	0.026	12:24	0	428	19.5
Week 7	**Day 1**	**11/21/2016**	0.00	11:22	0.036	11:24	0	407	2.8
	Day 2	**11/22/2016**	0.00	10:42	0.033	10:50	0	411	4.4
	Day 3	**11/23/2016**	0.00	10:37	0.017	10:26	0	408	7.3
Week 8	**Day 1**	**11/28/2016**	0.00	9:00	0.013	9:01	0	391	7.6
	Day 2	**11/30/2016**	0.00	8:36	0.000	8:58	0	406	4.5
	Day 3	**12/2/2016**	0.00	10:43	0.024	10:49	0	401	2.5
Week 9	**Day 1**	**12/5/2016**	0.00	8:43	0.008	8:52	0	401	3.7
	Day 2	**12/7/2016**	0.00	9:14	0.013	9:11	0	402	-5.3
	Day 3	**12/9/2016**	0.00	11:22	0.035	11:26	0	399	-3.4
Week 10	**Day 1**	**12/12/2016**	0.00	9:13	0.016	9:15	0	407	-9.0
	Day 2	**12/14/2016**	0.00	8:59	0.015	9:05	0	406	-13.4
	Day 3	**12/16/2016**	0.00	11:26	0.007	10:46	0	408	-6.5
Week 11	**Day 1**	**12/19/2016**	0.00	10:08	0.020	10:17	0	415	-10.8
	Day 2	**12/20/2016**	0.00	10:42	0.013	10:42	0	408	-0.9
	Day 3	**12/21/2016**	0.00	11:06	0.021	10:50	0	404	1.7
Week 12	**Day 1**	**12/27/2016**	0.00	11:11	0.024	11:11	0	393	-3.2
	Day 2	**12/28/2016**	0.00	11:31	0.012	11:31	0	397	4.0
	Day 3	**12/29/2016**	0.00	11:13	0.031	11:14	0	387	0.6

Table A-6

Average (Continued)

			Outdoor					
			IAQ Sensor					
		Date	TA	RH	DP	DP	WB	
			°F	%	°C	°F	°C	°F
Week 1	**Day 1**	**10/3/2016**	61.2	89.0	14.4	57.9	15.1	59.2
	Day 2	**10/5/2016**	70.9	75.7	17.0	62.6	18.5	65.3
	Day 3	**10/6/2016**	67.0	77.5	15.0	59.0	16.5	61.7
Week 2	**Day 1**	**10/10/2016**	59.4	69.1	9.5	49.1	11.9	53.4
	Day 2	**10/12/2016**	57.1	59.8	8.1	46.5	11.9	53.3
	Day 3	**10/13/2016**	51.5	54.0	1.7	35.1	6.6	43.8
Week 3	**Day 1**	**10/18/2016**	71.9	55.5	11.7	53.1	16.1	61.1
	Day 2	**10/20/2016**	52.7	59.9	3.8	38.8	7.7	45.8
	Day 3	**10/21/2016**	45.0	61.5	0.3	32.5	4.1	39.4
Week 4	**Day 1**	**11/1/2016**	62.8	51.6	7.1	44.8	11.7	53.0
	Day 2	**11/2/2016**	58.4	68.2	8.9	47.9	11.2	52.2
	Day 3	**11/3/2016**	56.2	59.7	5.5	41.9	9.1	48.4
Week 5	**Day 1**	**11/8/2016**	57.3	54.2	4.4	39.8	9.2	48.6
	Day 2	**11/9/2016**	60.4	45.3	3.0	37.5	9.5	49.1
	Day 3	**11/10/2016**	51.9	51.3	0.6	33.0	6.3	43.3
Week 6	**Day 1**	**11/14/2016**	53.4	57.1	3.3	38.0	7.6	45.6
	Day 2	**11/15/2016**	53.6	63.0	5.1	41.2	8.5	47.2
	Day 3	**11/17/2016**	67.0	52.3	9.1	48.3	13.5	56.3
Week 7	**Day 1**	**11/21/2016**	37.1	48.3	-8.0	17.6	-1.4	29.6
	Day 2	**11/22/2016**	40.0	68.7	-1.0	30.2	2.2	36.0
	Day 3	**11/23/2016**	52.5	86.5	5.4	41.7	6.3	43.4
Week 8	**Day 1**	**11/28/2016**	45.6	75.8	3.3	38.0	5.6	42.0
	Day 2	**11/30/2016**	40.1	76.3	0.7	33.3	3.0	37.4
	Day 3	**12/2/2016**	36.5	58.8	-4.9	23.2	-0.2	31.6
Week 9	**Day 1**	**12/5/2016**	38.7	81.9	0.9	33.6	2.5	36.4
	Day 2	**12/7/2016**	22.4	65.5	-10.5	13.0	-6.3	20.6
	Day 3	**12/9/2016**	26.0	51.9	-12.3	9.9	-5.8	21.6
Week 10	**Day 1**	**12/12/2016**	15.7	62.0	-15.2	4.6	-5.1	22.8
	Day 2	**12/14/2016**	7.8	55.5	-15.9	3.5		
	Day 3	**12/16/2016**	20.3	44.3	-16.9	1.5		
Week 11	**Day 1**	**12/19/2016**	12.5	58.0	-14.3	6.3	-4.8	23.4
	Day 2	**12/20/2016**	30.5	59.1	-8.0	17.6	-3.2	26.3
	Day 3	**12/21/2016**	35.1	64.4	-4.4	24.1	-0.6	30.9
Week 12	**Day 1**	**12/27/2016**	26.3	65.9	-8.6	16.6	-4.8	23.3
	Day 2	**12/28/2016**	39.2	56.4	-4.3	24.2	0.7	33.3
	Day 3	**12/29/2016**	33.0	64.7	-5.3	22.4	-1.6	29.2

Appendix B – Tabulated Data by Contaminant

Data are presented in tables by contaminant. Invalid values, as determined in the Data Analysis section, have been omitted. The basic statistical values of maximum, minimum, average, median, range, and standard deviation, as referenced in the Results and Discussion section, are included.

Table B-1. $PM_{2.5}$.

Table B-2. PM_{10}.

Table B-3. NO_2.

Table B-4. SO_2.

Table B-5. O_3.

Table B-6. CO.

Table B-7. CO_2.

Table B-8. TA.

Table B-9. RH.

Table B-10. DP.

Table B-11. WB.

Table B-1

PM $_{2.5}$

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:54	7:36	6:36	2.4	8:28		6:31	3.2	8:19
	Day 2	**10/5/2016**	11:43	11:25	6:47	3.0	14:22	4.2	10:29	3.6	13:26
	Day 3	**10/6/2016**	9:11	8:55	6:26	2.5	8:02	5.2	6:48	4.1	14:55
Week 2	**Day 1**	**10/10/2016**	7:46	7:36	6:30	2.0	8:06	4.5	6:31	2.2	8:51
	Day 2	**10/12/2016**	12:59	12:41	6:13	2.3	14:26	1.7	14:17	3.2	15:53
	Day 3	**10/13/2016**	9:23	9:12	6:37	1.8	8:09	2.7	6:41	1.1	16:30
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:10	1.5	14:31	2.4	6:59	2.9	17:47
	Day 2	**10/20/2016**	10:17	9:59	6:10	1.4	8:06	2.9	13:13	1.9	14:38
	Day 3	**10/21/2016**	6:47	6:30					6:30	1.0	
Week 4	**Day 1**	**11/1/2016**	12:30	12:14	16:01	2.4	8:37	3.6	7:22	1.6	14:37
	Day 2	**11/2/2016**	11:42	11:24	6:52	2.4	8:22	2.4	15:09	2.4	16:30
	Day 3	**11/3/2016**	9:41	9:31	6:46	1.4	8:06	2.4	6:07	1.7	13:01
Week 5	**Day 1**	**11/8/2016**	10:39	10:27	15:10	1.1	8:24	1.9	7:15	3.8	10:18
	Day 2	**11/9/2016**	11:46	11:28	15:51	1.5	14:19	1.7	11:35	1.2	7:01
	Day 3	**11/10/2016**	9:09	8:50	6:27	1.8	8:04	1.3	7:32	1.4	12:18
Week 6	**Day 1**	**11/14/2016**	9:33	10:23	6:17	1.7	8:08	2.2	7:15	2.0	16:45
	Day 2	**11/15/2016**	9:49	9:39	7:16	2.8	8:53	4.2	12:07	2.7	9:26
	Day 3	**11/17/2016**	12:23	12:04	10:30		12:05	4.7	15:32	3.8	8:41
Week 7	**Day 1**	**11/21/2016**	11:10	11:07	7:31	1.6	9:02	2.3	12:38	1.5	15:28
	Day 2	**11/22/2016**	10:48	10:46	7:14	2.2	8:44	2.8	12:08	1.6	15:33
	Day 3	**11/23/2016**	10:18	10:10	6:55	2.6	8:24	2.3	11:43	2.7	13:49
Week 8	**Day 1**	**11/28/2016**	8:45	8:39	7:08	2.3	8:54	2.1	7:36	2.8	9:34
	Day 2	**11/30/2016**	8:37	8:38	7:06	1.5	8:24	2.1	7:09	1.9	10:38
	Day 3	**12/2/2016**	10:35	10:29	7:02	2.2	8:30	1.7	12:06	1.6	14:21
Week 9	**Day 1**	**12/5/2016**	8:30	8:13	7:18	3.5	7:18	3.1	7:13	1.5	9:03
	Day 2	**12/7/2016**	9:12	9:09	7:47	1.7	9:15	3.2	7:44	1.4	10:08
	Day 3	**12/9/2016**	11:16	11:12	7:43	1.2	9:10	2.6	12:52	2.0	15:16
Week 10	**Day 1**	**12/12/2016**	9:13	9:11	7:34	2.2	9:06	3.2	7:54	2.2	10:45
	Day 2	**12/14/2016**	8:57	8:55	7:35	2.1	8:59	1.9	7:46	2.2	10:10
	Day 3	**12/16/2016**	11:23	11:18	7:38	2.0	9:02	2.6	13:09	2.1	15:20
Week 11	**Day 1**	**12/19/2016**	9:51	9:32	7:23	2.0	8:43	3.4	7:15	2.2	14:03
	Day 2	**12/20/2016**	10:32	10:27	12:21	1.9	13:59	3.5	7:30	1.5	9:30
	Day 3	**12/21/2016**	10:42	10:37	9:41	3.4	8:21	2.4	12:50	2.9	11:10
Week 12	**Day 1**	**12/27/2016**	11:01	10:56	11:02	2.4	12:18	2.6	7:24	2.1	15:08
	Day 2	**12/28/2016**	11:23	11:17	10:53	3.5	9:16	3.5	13:00	1.9	15:22
	Day 3	**12/29/2016**	11:06	11:02	10:33	2.0	8:56	1.9	7:24	1.7	15:20

Table B-1

PM $_{2.5}$ (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						3.5		5.2		4.1	
Minimum						1.1		1.3		1.0	
Average						2.1		2.8		2.2	
Median						2.1		2.6		2.1	
Range						2.4		3.9		3.1	
Std. Deviation						0.6		0.9		0.8	

Table B-1

$PM_{2.5}$ (Continued)

			Indoor			Avg.	Outdoor				
		Date	Location			Outdoor T	Time	Location			
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time
Week 1	**Day 1**	**10/3/2016**	4.0	8:10	9.3	8:11	7:04	8.4	9:06		7:09
	Day 2	**10/5/2016**	5.0	12:04	10.6	12:02	7:29	16.6	15:00	11.0	11:05
	Day 3	**10/6/2016**	1.7	8:27	9.8	9:27	7:04	19.4	8:37	9.9	7:28
Week 2	**Day 1**	**10/10/2016**	3.1	8:03	3.8	7:57	7:04	8.1	8:45	10.4	7:03
	Day 2	**10/12/2016**	1.9	12:37		13:18	6:51	9.4	15:05	3.5	14:53
	Day 3	**10/13/2016**	1.8	8:04	2.1	9:34	7:13	12.4	8:45	5.0	7:17
Week 3	**Day 1**	**10/18/2016**	1.7	8:19	5.6	13:20	16:46	2.5	15:06	2.0	7:34
	Day 2	**10/20/2016**	2.4	7:52	1.8	10:35	6:45	7.0	8:42	8.7	13:51
	Day 3	**10/21/2016**				7:04					7:04
Week 4	**Day 1**	**11/1/2016**	2.0	14:35	7.4	12:47	16:35	9.3	9:16	9.7	7:58
	Day 2	**11/2/2016**	2.4	10:08	4.9	12:00	7:30	8.9	8:58	8.3	15:44
	Day 3	**11/3/2016**	2.1	13:36	3.1	9:50	7:23	6.2	8:41	9.6	6:34
Week 5	**Day 1**	**11/8/2016**	5.6	11:12	4.2	10:51	15:45	2.0	8:59	4.6	7:56
	Day 2	**11/9/2016**	2.1	8:36	8.3	12:04	16:31	3.3	14:53	2.9	12:07
	Day 3	**11/10/2016**	1.3	9:51	2.9	9:29	7:12	2.2	8:35	6.7	8:09
Week 6	**Day 1**	**11/14/2016**	3.1	13:31	4.8	8:44	6:55	6.2	8:45	7.5	7:55
	Day 2	**11/15/2016**	4.8	10:34	6.3	9:59	7:52	18.1	9:26	15.9	12:41
	Day 3	**11/17/2016**		13:35	6.4	12:42	12:41	16.2	12:40	16.5	16:09
Week 7	**Day 1**	**11/21/2016**	1.7	10:56	2.5	11:14	8:06	4.0	9:38	2.4	13:07
	Day 2	**11/22/2016**	2.2	10:15	3.3	10:50	7:48	8.8	9:20	2.7	12:40
	Day 3	**11/23/2016**	3.7	10:03	4.7	10:25	7:22	12.1	8:52	9.3	12:13
Week 8	**Day 1**	**11/28/2016**	3.5	10:07	3.4	8:51	7:34	5.0	9:11	5.3	8:07
	Day 2	**11/30/2016**	2.2	9:54	2.7	8:36	7:23	3.4	8:50	4.8	7:48
	Day 3	**12/2/2016**	1.9	10:30	2.7	10:41	7:31	3.4	9:04	3.8	12:34
Week 9	**Day 1**	**12/5/2016**	2.4	10:14	4.1	8:47	7:53	16.3	9:13	15.4	7:40
	Day 2	**12/7/2016**	2.5	10:52	3.0	9:15	8:11	6.2	9:49	5.4	8:12
	Day 3	**12/9/2016**	1.9	11:01	2.4	11:20	8:02	3.2	9:40	2.9	13:19
Week 10	**Day 1**	**12/12/2016**	2.8	10:37	4.0	9:15	8:07	11.9	9:41	5.8	8:20
	Day 2	**12/14/2016**	3.4	10:08	2.8	8:58	7:52	3.6	9:14	3.7	8:20
	Day 3	**12/16/2016**	2.4	11:21	3.2	11:28	8:00	6.5	9:38	5.6	13:33
Week 11	**Day 1**	**12/19/2016**	2.5	10:19	3.8	10:09	7:47	7.1	9:13	9.1	8:00
	Day 2	**12/20/2016**	2.8	8:56	4.5	10:38	12:47	8.2	14:28	10.1	7:50
	Day 3	**12/21/2016**	3.3	11:04	3.3	10:48	10:12	9.5	8:47	12.3	13:15
Week 12	**Day 1**	**12/27/2016**	3.8	8:52	4.9	11:06	11:19	5.9	12:43	6.4	7:56
	Day 2	**12/28/2016**	3.2	7:55	9.5	11:30	11:19	9.9	9:52	9.8	13:26
	Day 3	**12/29/2016**	3.0	12:59	2.9	11:11	10:53	4.2	9:29	3.8	7:58

Table B-1

$PM_{2.5}$ (Continued)

			Indoor				Avg.	Outdoor				
		Date	Location				Outdoor T	Time	Location			
		Average	D	Time	E		hh:mm	hh:mm	A	Time	B	Time
			Values after Chauvenet's Statistical Rejection									
Maximum			5.6		10.6				19.4		16.5	
Minimum			1.3		1.8				2.0		2.0	
Average			2.8		4.7				8.2		7.4	
Median			2.5		3.9				7.1		6.6	
Range			4.3		8.8				17.4		14.5	
Std. Deviation			1.0		2.4				4.7		3.9	

Table B-1

PM $_{2.5}$ (Continued)

			Outdoor				
		Date	Location				
		Average	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	15.6	8:53	11.6	8:45	22.2
	Day 2	**10/5/2016**	18.5	14:00	18.4	12:37	19.6
	Day 3	**10/6/2016**	16.0	15:05	2.5	9:01	16.8
Week 2	**Day 1**	**10/10/2016**	7.3	8:17	6.7	8:37	6.5
	Day 2	**10/12/2016**	1.6	16:38	5.8	13:06	14.0
	Day 3	**10/13/2016**	2.8	15:55	8.9	8:40	3.6
Week 3	**Day 1**	**10/18/2016**	11.8	18:25	4.0	8:53	12.3
	Day 2	**10/20/2016**	5.2	15:15	5.2	8:26	2.9
	Day 3	**10/21/2016**	2.2				
Week 4	**Day 1**	**11/1/2016**	6.6	14:50	3.4	15:16	9.0
	Day 2	**11/2/2016**	12.1	17:03	6.0	10:46	9.1
	Day 3	**11/3/2016**	6.9	12:25	3.6	14:11	7.7
Week 5	**Day 1**	**11/8/2016**	20.9	9:53	13.2	11:46	7.6
	Day 2	**11/9/2016**	3.0	7:37	3.8	9:12	16.5
	Day 3	**11/10/2016**	5.0	13:03	2.9	10:26	3.1
Week 6	**Day 1**	**11/14/2016**	11.9	6:04	10.7	14:03	16.9
	Day 2	**11/15/2016**	16.2	8:48	13.2	11:08	16.6
	Day 3	**11/17/2016**	16.4	7:56	18.1	14:08	11.8
Week 7	**Day 1**	**11/21/2016**	4.2	13:53	3.0	11:29	3.3
	Day 2	**11/22/2016**	4.6	13:14	4.0	11:10	3.0
	Day 3	**11/23/2016**	12.8	13:03	12.3	10:38	12.0
Week 8	**Day 1**	**11/28/2016**	10.0	8:53	12.8	10:34	5.4
	Day 2	**11/30/2016**	8.6	8:37	7.5	10:22	4.7
	Day 3	**12/2/2016**	4.8	13:16	4.6	11:02	3.0
Week 9	**Day 1**	**12/5/2016**	10.1	8:31	10.1	10:38	19.5
	Day 2	**12/7/2016**	4.2	8:50	2.0	11:15	4.9
	Day 3	**12/9/2016**	2.9	13:58	3.4	11:42	3.0
Week 10	**Day 1**	**12/12/2016**	14.1	9:13	12.3	10:56	8.3
	Day 2	**12/14/2016**	7.9	9:05	6.8	10:23	3.5
	Day 3	**12/16/2016**	10.3	14:20	5.8	11:50	5.2
Week 11	**Day 1**	**12/19/2016**	5.0	15:03	6.0	10:45	7.5
	Day 2	**12/20/2016**	14.3	8:50	7.3	9:16	16.3
	Day 3	**12/21/2016**	8.7	10:10	17.7	11:39	10.7
Week 12	**Day 1**	**12/27/2016**	6.3	14:16	6.4	9:18	4.6
	Day 2	**12/28/2016**	5.3	14:14	7.9	8:40	13.5
	Day 3	**12/29/2016**	3.7	14:12	8.2	13:23	5.9

Table B-1

PM 2.5 (Continued)

			Outdoor				
		Date	Location				
		Average	C	Time	D	Time	E
			Values after Chauvenet's Stat				
Maximum			20.9		18.4		22.2
Minimum			1.6		2.0		2.9
Average			8.8		7.9		9.4
Median			7.6		6.7		7.7
Range			19.3		16.4		19.3
Std. Deviation			5.1		4.5		5.7

Table B-2

PM_{10}

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:54	7:36	6:36	2.6	8:28	7.3	6:31	3.4	8:19
	Day 2	**10/5/2016**	11:43	11:25	6:47	3.2	14:22	4.5	10:29	3.8	13:26
	Day 3	**10/6/2016**	9:11	8:55	6:26	2.7	8:02	5.5	6:48	4.4	14:55
Week 2	**Day 1**	**10/10/2016**	7:46	7:36	6:30	2.2	8:06	6.8	6:31	2.4	8:51
	Day 2	**10/12/2016**	12:59	12:41	6:13	2.5	14:26	1.8	14:17	3.4	15:53
	Day 3	**10/13/2016**	9:23	9:12	6:37	1.9	8:09	7.3	6:41	1.2	16:30
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:10	1.6	14:31	2.6	6:59	3.1	17:47
	Day 2	**10/20/2016**	10:17	9:59	6:10	1.5	8:06	3.1	13:13	3.5	14:38
	Day 3	**10/21/2016**	6:47	6:30					6:30	1.1	
Week 4	**Day 1**	**11/1/2016**	12:30	12:14	16:01	2.5	8:37	3.8	7:22	1.7	14:37
	Day 2	**11/2/2016**	11:42	11:24	6:52	2.6	8:22		15:09	2.6	16:30
	Day 3	**11/3/2016**	9:41	9:31	6:46	1.5	8:06	2.6	6:07	1.8	13:01
Week 5	**Day 1**	**11/8/2016**	10:39	10:27	15:10	1.2	8:24	3.7	7:15	4	10:18
	Day 2	**11/9/2016**	11:46	11:28	15:51	1.6	14:19	1.8	11:35	1.3	7:01
	Day 3	**11/10/2016**	9:09	8:50	6:27	1.9	8:04	1.4	7:32	1.5	12:18
Week 6	**Day 1**	**11/14/2016**	9:33	10:23	6:17	1.8	8:08	2.3	7:15	2.2	16:45
	Day 2	**11/15/2016**	9:49	9:39	7:16	3.3	8:53	5.6	12:07	3.8	9:26
	Day 3	**11/17/2016**	12:23	12:04	10:30		12:05	5.1	15:32	4	8:41
Week 7	**Day 1**	**11/21/2016**	11:10	11:07	7:31	1.7	9:02	2.5	12:38	1.6	15:28
	Day 2	**11/22/2016**	10:48	10:46	7:14	2.4	8:44	3.2	12:08	1.7	15:33
	Day 3	**11/23/2016**	10:18	10:10	6:55	2.8	8:24	6.1	11:43	2.9	13:49
Week 8	**Day 1**	**11/28/2016**	8:45	8:39	7:08	2.5	8:54	2.3	7:36	4.2	9:34
	Day 2	**11/30/2016**	8:37	8:38	7:06	1.6	8:24	2.3	7:09	2	10:38
	Day 3	**12/2/2016**	10:35	10:29	7:02	3.9	8:30	1.9	12:06	1.7	14:21
Week 9	**Day 1**	**12/5/2016**	8:30	8:13	7:18	3.7	7:18	3.9	7:13	1.6	9:03
	Day 2	**12/7/2016**	9:12	9:09	7:47	1.8	9:15	3.4	7:44	1.5	10:08
	Day 3	**12/9/2016**	11:16	11:12	7:43	1.3	9:10	4.7	12:52	2.2	15:16
Week 10	**Day 1**	**12/12/2016**	9:13	9:11	7:34	2.4	9:06	3.4	7:54	2.4	10:45
	Day 2	**12/14/2016**	8:57	8:55	7:35	2.3	8:59	2.0	7:46	2.5	10:10
	Day 3	**12/16/2016**	11:23	11:18	7:38	2.2	9:02	2.8	13:09	2.3	15:20
Week 11	**Day 1**	**12/19/2016**	9:51	9:32	7:23	2.2	8:43	3.6	7:15	2.4	14:03
	Day 2	**12/20/2016**	10:32	10:27	12:21	2.0	13:59	4.7	7:30	1.6	9:30
	Day 3	**12/21/2016**	10:42	10:37	9:41	3.6	8:21	2.6	12:50	3.1	11:10
Week 12	**Day 1**	**12/27/2016**	11:01	10:56	11:02	2.6	12:18	2.8	7:24	2.3	15:08
	Day 2	**12/28/2016**	11:23	11:17	10:53	3.7	9:16	4.2	13:00	2	15:22
	Day 3	**12/29/2016**	11:06	11:02	10:33	2.2	8:56	2.0	7:24	1.8	15:20

Table B-2

PM_{10} (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						3.9		7.3		4.4	
Minimum						1.2		1.4		1.1	
Average						2.3		3.6		2.5	
Median						2.3		3.3		2.3	
Range						2.7		5.9		3.3	
Std. Deviation						0.7		1.6		0.9	

Table B-2

PM $_{10}$ (Continued)

			Indoor			Avg.	Outdoor				
		Date	Location			Indoor T	Time	Location			
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time
Week 1	**Day 1**	**10/3/2016**	4.1	8:10	9.8	8:11	7:04	9.1	9:06	20.8	7:09
	Day 2	**10/5/2016**	5.5	12:04	11.2	12:02	7:29	18.3	15:00	11.7	11:05
	Day 3	**10/6/2016**	1.8	8:27	10.3	9:27	7:04	23.0	8:37	15.7	7:28
Week 2	**Day 1**	**10/10/2016**	3.3	8:03	4.0	7:57	7:04	13.2	8:45	17.3	7:03
	Day 2	**10/12/2016**	2.0	12:37	14.2	13:18	6:51	10.4	15:05	3.7	14:53
	Day 3	**10/13/2016**	1.9	8:04	5.6	9:34	7:13	19.5	8:45	5.9	7:17
Week 3	**Day 1**	**10/18/2016**	1.8	8:19	5.9	13:20	16:46	2.7	15:06	2.4	7:34
	Day 2	**10/20/2016**	2.6	7:52	1.9	10:35	6:45	7.4	8:42	13.0	13:51
	Day 3	**10/21/2016**				7:04					7:04
Week 4	**Day 1**	**11/1/2016**	2.2	14:35	13.1	12:47	16:35	11.2	9:16	15.7	7:58
	Day 2	**11/2/2016**	2.6	10:08	6.7	12:00	7:30	12.0	8:58	8.8	15:44
	Day 3	**11/3/2016**	3.0	13:36	3.3	9:50	7:23	6.7	8:41	17.3	6:34
Week 5	**Day 1**	**11/8/2016**	8.6	11:12	4.5	10:51	15:45	2.2	8:59	9.3	7:56
	Day 2	**11/9/2016**	2.3	8:36	8.8	12:04	16:31	5.5	14:53	8.4	12:07
	Day 3	**11/10/2016**	6.0	9:51	4.1	9:29	7:12	2.4	8:35	9.0	8:09
Week 6	**Day 1**	**11/14/2016**	3.3	13:31	5.1	8:44	6:55	13.3	8:45	10.6	7:55
	Day 2	**11/15/2016**	5.1	10:34	8.1	9:59	7:52	23.5	9:26	22.0	12:41
	Day 3	**11/17/2016**		13:35	6.8	12:42	12:41	26.8	12:40	22.1	16:09
Week 7	**Day 1**	**11/21/2016**	1.8	10:56	2.7	11:14	8:06	4.3	9:38	2.6	13:07
	Day 2	**11/22/2016**	2.4	10:15	5.7	10:50	7:48	15.9	9:20	2.9	12:40
	Day 3	**11/23/2016**	5.2	10:03	6.2	10:25	7:22	16.0	8:52	10.1	12:13
Week 8	**Day 1**	**11/28/2016**	8.4	10:07	3.6	8:51	7:34	5.3	9:11	5.6	8:07
	Day 2	**11/30/2016**	2.5	9:54	3.9	8:36	7:23	3.6	8:50	5.1	7:48
	Day 3	**12/2/2016**	2.0	10:30	2.9	10:41	7:31	3.6	9:04	4.0	12:34
Week 9	**Day 1**	**12/5/2016**	2.6	10:14	4.4	8:47	7:53	25.7	9:13	20.6	7:40
	Day 2	**12/7/2016**	2.7	10:52	3.3	9:15	8:11	9.6	9:49	5.7	8:12
	Day 3	**12/9/2016**	2.0	11:01	2.6	11:20	8:02	3.4	9:40	3.2	13:19
Week 10	**Day 1**	**12/12/2016**	3.0	10:37	4.3	9:15	8:07	16.1	9:41	6.1	8:20
	Day 2	**12/14/2016**	3.6	10:08	3.0	8:58	7:52	6.2	9:14	4.8	8:20
	Day 3	**12/16/2016**	4.2	11:21	3.4	11:28	8:00	6.9	9:38	5.9	13:33
Week 11	**Day 1**	**12/19/2016**	2.7	10:19	4.5	10:09	7:47	9.4	9:13	10.5	8:00
	Day 2	**12/20/2016**	3.0	8:56	5.2	10:38	12:47	11.4	14:28	10.9	7:50
	Day 3	**12/21/2016**	3.5	11:04	3.5	10:48	10:12	11.1	8:47	15.1	13:15
Week 12	**Day 1**	**12/27/2016**	5.0	8:52	5.2	11:06	11:19	8.9	12:43	6.8	7:56
	Day 2	**12/28/2016**	5.4	7:55		11:30	11:19	13.1	9:52	17.2	13:26
	Day 3	**12/29/2016**	3.2	12:59	3.1	11:11	10:53	4.5	9:29	4.0	7:58

Table B-2

PM $_{10}$ (Continued)

			Indoor			Avg.	Outdoor				
		Date	Location			Indoor T	Time	Location			
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time
			Values after Chauvenet's Statistical Rejection								
Maximum			8.6		14.2			26.8		22.1	
Minimum			1.8		1.9			2.2		2.4	
Average			3.5		5.6			10.9		10.1	
Median			3.0		4.5			9.6		9.0	
Range			6.8		12.3			24.6		19.7	
Std. Deviation			1.7		3.0			6.8		6.0	

Table B-2

PM_{10} (Continued)

			Outdoor				
		Date	Location				
		Average	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	20.2	8:53	15.6	8:45	25.5
	Day 2	**10/5/2016**	23.3	14:00	19.2	12:37	21.7
	Day 3	**10/6/2016**	16.7	15:05	3.1	9:01	22.0
Week 2	**Day 1**	**10/10/2016**	7.7	8:17	7.7	8:37	7.5
	Day 2	**10/12/2016**	1.7	16:38	6.1	13:06	21.1
	Day 3	**10/13/2016**	3.8	15:55	10.5	8:40	7.0
Week 3	**Day 1**	**10/18/2016**	15.5	18:25	4.3	8:53	18.1
	Day 2	**10/20/2016**	5.5	15:15	9.0	8:26	3.2
	Day 3	**10/21/2016**	2.4				
Week 4	**Day 1**	**11/1/2016**	7.0	14:50	3.6	15:16	12.0
	Day 2	**11/2/2016**	15.0	17:03	8.2	10:46	12.4
	Day 3	**11/3/2016**	7.2	12:25	3.8	14:11	11.8
Week 5	**Day 1**	**11/8/2016**	30.5	9:53	19.9	11:46	10.2
	Day 2	**11/9/2016**	3.2	7:37	4.6	9:12	23.3
	Day 3	**11/10/2016**	5.7	13:03	3.1	10:26	3.3
Week 6	**Day 1**	**11/14/2016**	19.2	6:04	19.6	14:03	19.0
	Day 2	**11/15/2016**	26.8	8:48	18.9	11:08	23.7
	Day 3	**11/17/2016**	23.0	7:56	27.2	14:08	17.3
Week 7	**Day 1**	**11/21/2016**	4.5	13:53	3.2	11:29	3.6
	Day 2	**11/22/2016**	4.9	13:14	4.3	11:10	3.2
	Day 3	**11/23/2016**	19.1	13:03	16.0	10:38	13.7
Week 8	**Day 1**	**11/28/2016**	12.6	8:53	21.0	10:34	7.6
	Day 2	**11/30/2016**	13.5	8:37	9.4	10:22	4.9
	Day 3	**12/2/2016**	5.0	13:16	4.9	11:02	5.0
Week 9	**Day 1**	**12/5/2016**	14.0	8:31	17.6	10:38	29.2
	Day 2	**12/7/2016**	4.5	8:50	2.4	11:15	5.2
	Day 3	**12/9/2016**	4.0	13:58	3.6	11:42	3.2
Week 10	**Day 1**	**12/12/2016**	19.6	9:13	26.4	10:56	19.3
	Day 2	**12/14/2016**	12.0	9:05	10.8	10:23	4.1
	Day 3	**12/16/2016**	29.6	14:20	8.3	11:50	10.3
Week 11	**Day 1**	**12/19/2016**	7.0	15:03	6.4	10:45	9.3
	Day 2	**12/20/2016**	21.0	8:50	7.7	9:16	25.5
	Day 3	**12/21/2016**	11.6	10:10		11:39	12.6
Week 12	**Day 1**	**12/27/2016**	6.7	14:16	7.2	9:18	5.1
	Day 2	**12/28/2016**	8.2	14:14	10.7	8:40	21.8
	Day 3	**12/29/2016**	3.9	14:12	8.7	13:23	6.2

Table B-2

PM $_{10}$ (Continued)

			Outdoor				
		Date	Location				
		Average	C	Time	D	Time	E
			Values after Chauvenet's Stat				
Maximum			30.5		27.2		29.2
Minimum			1.7		2.4		3.2
Average			12.1		10.4		12.8
Median			9.9		8.3		11.8
Range			28.8		24.8		26.0
Std. Deviation			8.1		7.0		7.9

Table B-3

NO_2

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**	8:10	7:58	6:44	0.016	8:36	0.018	6:48	0.011
	Day 2	**10/5/2016**	12:00	11:54	7:15	0.013	14:55	0.016	10:59	0.018
	Day 3	**10/6/2016**	10:01	10:26	6:32	0.012	8:31	0.015	7:08	0.003
Week 2	**Day 1**	**10/10/2016**	8:03	7:59	6:59	0.020	8:27	0.024	6:37	0.019
	Day 2	**10/12/2016**	13:15	13:01	6:42	0.014	14:34	0.014	14:47	0.011
	Day 3	**10/13/2016**	9:35	9:17	6:44	0.013	8:17	0.012	6:46	0.012
Week 3	**Day 1**	**10/18/2016**	13:19	13:02	16:18	0.030	14:40	0.025	7:27	0.019
	Day 2	**10/20/2016**	10:27	10:11	6:18	0.018	8:15	0.016	13:22	0.014
	Day 3	**10/21/2016**	6:55	6:37					6:37	0.015
Week 4	**Day 1**	**11/1/2016**	12:45	12:32	16:30	0.023	9:07	0.021	7:39	0.022
	Day 2	**11/2/2016**	12:02	11:45	7:01	0.027	8:53	0.016	15:37	0.023
	Day 3	**11/3/2016**	10:00	9:52	7:16	0.020	8:37	0.009	6:15	0.008
Week 5	**Day 1**	**11/8/2016**	11:03	10:56	15:39	0.029	8:55	0.028	7:46	0.026
	Day 2	**11/9/2016**	12:06	11:57	16:22	0.023	14:49	0.033	11:59	0.025
	Day 3	**11/10/2016**	9:36	9:21	6:56	0.021	8:32	0.021	8:02	0.028
Week 6	**Day 1**	**11/14/2016**	9:52	10:51	6:48	0.025	8:40	0.032	7:47	0.024
	Day 2	**11/15/2016**	10:14	10:08	7:44		9:21	0.027	12:36	0.022
	Day 3	**11/17/2016**	12:50	12:40	11:00	0.026	12:36	0.026	16:03	0.030
Week 7	**Day 1**	**11/21/2016**	11:33	11:33	7:58	0.025	9:33	0.031	13:01	0.014
	Day 2	**11/22/2016**	10:55	10:50	7:02	0.031	8:54	0.038	12:20	0.030
	Day 3	**11/23/2016**	10:35	10:19	6:57	0.034	8:36	0.024	12:07	0.027
Week 8	**Day 1**	**11/28/2016**	9:10	9:04	7:29	0.026	9:04	0.031	8:01	0.000
	Day 2	**11/30/2016**	9:02	9:04	7:17	0.021	8:54	0.025	7:36	0.025
	Day 3	**12/2/2016**	9:51	10:43	7:16	0.028	8:29	0.032	12:22	0.020
Week 9	**Day 1**	**12/5/2016**	8:55	8:49	7:28	0.028	9:00	0.027	7:23	0.000
	Day 2	**12/7/2016**	9:27	9:21	7:56	0.019	9:34	0.020	7:51	0.024
	Day 3	**12/9/2016**	11:32	11:26	7:52	0.025	9:23	0.002	13:05	0.017
Week 10	**Day 1**	**12/12/2016**	9:31	9:19	7:42	0.022	9:14	0.035	8:02	0.024
	Day 2	**12/14/2016**	8:57	8:55	7:43	0.025	9:09	0.036	7:32	0.019
	Day 3	**12/16/2016**	11:31	11:28	7:47	0.033	9:12	0.046	13:21	0.037
Week 11	**Day 1**	**12/19/2016**	10:04	9:51	7:33	0.032	8:57	0.035	7:36	0.034
	Day 2	**12/20/2016**	10:41	10:37	12:34	0.034	14:13	0.046	7:38	0.038
	Day 3	**12/21/2016**	10:51	10:51	10:01	0.024	8:34	0.039	13:01	0.034
Week 12	**Day 1**	**12/27/2016**	11:13	11:13	11:10	0.024	12:31	0.039	7:45	0.031
	Day 2	**12/28/2016**	11:36	11:35	11:05	0.035	9:39	0.033	13:15	0.033
	Day 3	**12/29/2016**	11:21	11:17	10:45	0.024	9:11	0.031	7:44	0.029

Table B-3

NO_2 (Continued)

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection							
Maximum						0.035		0.046		0.038
Minimum						0.012		0.002		0.000
Average						0.024		0.026		0.021
Median						0.025		0.027		0.023
Range						0.023		0.044		0.038
Std. Deviation						0.006		0.010		0.010

Table B-3

NO_2 (Continued)

			Indoor				Avg.	Outdoor		
		Date	Location				Indoor T	Time	Location	
		Average	Time	D	Time	E	hh:mm	hh:mm	A	Time
Week 1	**Day 1**	**10/3/2016**	9:01		8:41	0.013	8:22	7:11	0.053	9:36
	Day 2	**10/5/2016**	14:09	0.023	12:12	0.025	12:07	7:29	0.046	15:18
	Day 3	**10/6/2016**	14:27	0.013	15:36	0.023	9:36	7:04	0.044	8:43
Week 2	**Day 1**	**10/10/2016**	9:41	0.025	8:12	0.013	8:08	7:04	0.066	8:52
	Day 2	**10/12/2016**	16:08	0.027	12:54	0.025	13:29	6:51	0.051	15:20
	Day 3	**10/13/2016**	16:05	0.015	8:35	0.008	9:54	7:13	0.090	9:03
Week 3	**Day 1**	**10/18/2016**	18:20	0.019	8:28	0.024	13:37	16:46	0.055	15:16
	Day 2	**10/20/2016**	14:48	0.019	8:12	0.003	10:44	6:45	0.057	8:50
	Day 3	**10/21/2016**					7:13			
Week 4	**Day 1**	**11/1/2016**	14:31	0.026	14:53	0.020	12:59	16:35	0.038	9:31
	Day 2	**11/2/2016**	16:59	0.016	10:17	0.018	12:18	7:30	0.063	9:27
	Day 3	**11/3/2016**	13:07	0.012	14:07	0.019	10:07	7:23	0.061	9:11
Week 5	**Day 1**	**11/8/2016**	10:38	0.013	11:43	0.022	11:11	15:45	0.060	9:30
	Day 2	**11/9/2016**	7:29	0.027	9:08	0.014	12:14	16:31	0.050	15:23
	Day 3	**11/10/2016**	12:57	0.022	10:22	0.030	9:51	7:12	0.050	8:55
Week 6	**Day 1**	**11/14/2016**	17:00	0.034	14:00	0.026	8:54	6:55	0.062	9:04
	Day 2	**11/15/2016**	9:58	0.026	11:04	0.014	10:20	7:52	0.058	9:55
	Day 3	**11/17/2016**	9:36	0.021	14:05	0.031	13:01	12:41		13:12
Week 7	**Day 1**	**11/21/2016**	15:51	0.033	11:24	0.020	11:34	8:06	0.070	9:57
	Day 2	**11/22/2016**	15:11	0.030	10:45	0.032	11:00	7:48	0.098	9:29
	Day 3	**11/23/2016**	13:22	0.043	10:34	0.023	10:52	7:22	0.062	9:11
Week 8	**Day 1**	**11/28/2016**	10:20	0.027	10:29	0.022	9:15	7:34	0.077	9:39
	Day 2	**11/30/2016**	11:18	0.026	10:19	0.013	8:59	7:23	0.059	9:28
	Day 3	**12/2/2016**	14:39	0.023	10:51	0.025	8:58	7:31	0.068	9:27
Week 9	**Day 1**	**12/5/2016**	9:49	0.025	10:25	0.018	9:01	7:53	0.079	9:35
	Day 2	**12/7/2016**	10:26	0.029	11:02	0.012	9:32	8:11	0.064	10:10
	Day 3	**12/9/2016**	15:18	0.027	11:33	0.026	11:38	8:02	0.070	9:58
Week 10	**Day 1**	**12/12/2016**	10:54	0.028	10:47	0.015	9:43			9:51
	Day 2	**12/14/2016**	9:52	0.027	10:22	0.031	8:59			
	Day 3	**12/16/2016**	15:26	0.033	11:34	0.041	11:35	8:00	0.095	9:36
Week 11	**Day 1**	**12/19/2016**	14:41	0.041	10:29	0.038	10:18	7:47	0.106	9:32
	Day 2	**12/20/2016**	9:42	0.030	9:02	0.037	10:46	12:47	0.068	14:38
	Day 3	**12/21/2016**	11:14	0.032	11:29	0.038	10:50	10:12	0.052	8:46
Week 12	**Day 1**	**12/27/2016**	15:37	0.036	9:05	0.030	11:13	11:19	0.058	13:06
	Day 2	**12/28/2016**	15:43	0.035	8:15	0.030	11:38	11:19	0.053	10:12
	Day 3	**12/29/2016**	15:30	0.030	13:15	0.032	11:26	10:53	0.056	9:38

Table B-3

NO_2 (Continued)

			Indoor				Avg.	Outdoor		
		Date	Location				Indoor T	Time	Location	
		Average	Time	D	Time	E	hh:mm	hh:mm	A	Time
			Values after Chauvenet's Statistical Rejection							
Maximum				0.043		0.041			0.106	
Minimum				0.012		0.003			0.038	
Average				0.026		0.023			0.064	
Median				0.027		0.023			0.061	
Range				0.031		0.038			0.068	
Std. Deviation				0.007		0.009			0.016	

Table B-3

NO_2 (Continued)

			Outdoor						
		Date	Location						
		Average	B	Time	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	0.043	7:28	0.040	8:47	0.027	8:52	0.036
	Day 2	**10/5/2016**	0.036	11:24	0.038	13:44		12:41	0.018
	Day 3	**10/6/2016**	0.048	7:45	0.047	15:08	0.057	9:22	0.041
Week 2	**Day 1**	**10/10/2016**	0.060	7:12	0.056	8:46	0.038	8:46	0.053
	Day 2	**10/12/2016**	0.068	15:02	0.041	16:47	0.022	13:28	0.040
	Day 3	**10/13/2016**	0.059	7:25	0.079	16:42	0.045	9:09	0.060
Week 3	**Day 1**	**10/18/2016**	0.044	8:04	0.042	18:35	0.051	9:25	0.035
	Day 2	**10/20/2016**	0.065	13:59	0.050	15:23	0.040	8:46	0.062
	Day 3	**10/21/2016**		7:13	0.069				
Week 4	**Day 1**	**11/1/2016**	0.050	8:14	0.061	15:10	0.051	15:27	0.051
	Day 2	**11/2/2016**	0.041	16:12	0.042	17:22	0.055	11:03	0.060
	Day 3	**11/3/2016**	0.047	6:51		12:34	0.050	14:40	0.047
Week 5	**Day 1**	**11/8/2016**	0.051	8:23	0.044	10:14	0.032	12:05	0.065
	Day 2	**11/9/2016**	0.045	11:34	0.052	8:05	0.054	9:41	0.042
	Day 3	**11/10/2016**	0.051	8:40	0.047	13:34	0.048	10:55	0.056
Week 6	**Day 1**	**11/14/2016**	0.051	8:24	0.053	5:36	0.048	14:35	0.043
	Day 2	**11/15/2016**	0.047	13:10	0.042	9:08	0.032	11:37	0.043
	Day 3	**11/17/2016**	0.049	16:26	0.070	8:17	0.038	14:30	0.054
Week 7	**Day 1**	**11/21/2016**	0.067	13:26	0.070	14:23	0.045	11:59	0.067
	Day 2	**11/22/2016**	0.051	12:55	0.050	13:41	0.045	11:09	0.027
	Day 3	**11/23/2016**	0.055	12:32	0.052	14:21	0.020	10:55	0.060
Week 8	**Day 1**	**11/28/2016**	0.061	8:36	0.063	9:23	0.043	11:05	0.052
	Day 2	**11/30/2016**	0.059	8:11	0.047	9:01	0.025	10:53	0.047
	Day 3	**12/2/2016**	0.052	12:57	0.052	13:46	0.037	1:13	0.065
Week 9	**Day 1**	**12/5/2016**	0.054	8:00	0.057	8:43	0.041	10:58	
	Day 2	**12/7/2016**	0.054	8:27	0.049	9:17	0.039	11:36	0.068
	Day 3	**12/9/2016**	0.063	13:39	0.058	14:26	0.048	12:07	0.049
Week 10	**Day 1**	**12/12/2016**	0.049	8:40	0.050	9:22	0.040	11:00	0.066
	Day 2	**12/14/2016**		8:33	0.049	9:25	0.038		
	Day 3	**12/16/2016**	0.063	13:48	0.053	14:35	0.044	12:00	0.054
Week 11	**Day 1**	**12/19/2016**	0.070	8:16	0.044	15:15	0.059	10:41	0.060
	Day 2	**12/20/2016**	0.055	8:05	0.052	9:06	0.047	9:14	0.062
	Day 3	**12/21/2016**	0.064	13:17	0.056	10:16	0.044	11:41	0.060
Week 12	**Day 1**	**12/27/2016**	0.050	8:22	0.046	14:05	0.044	9:16	0.058
	Day 2	**12/28/2016**	0.047	13:40	0.038	14:34	0.040	8:27	0.060
	Day 3	**12/29/2016**	0.050	8:11	0.048	14:38	0.037	13:50	0.049

Table B-3

NO_2 (Continued)

			Outdoor						
		Date	Location						
		Average	B	Time	C	Time	D	Time	E
			Values after Chauvenet's Statistical Rejection						
Maximum			0.070		0.079		0.059		0.068
Minimum			0.036		0.038		0.020		0.018
Average			0.054		0.052		0.042		0.052
Median			0.051		0.050		0.044		0.054
Range			0.034		0.041		0.039		0.050
Std. Deviation			0.008		0.010		0.009		0.012

Table B-4

SO_2

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**	8:13	8:08	6:56	0.05	8:59	0.03	6:58	0.03
	Day 2	**10/5/2016**	10:41	9:15	7:15	0.08	1:43	0.08	10:36	0.01
	Day 3	**10/6/2016**	9:25	9:01	6:32	0.04	8:20	0.02	6:57	
Week 2	**Day 1**	**10/10/2016**	8:07	7:58	6:59	0.01	8:15	0.01	6:59	0.00
	Day 2	**10/12/2016**	13:20	13:01	6:42	0.01	14:45	0.02	14:36	0.02
	Day 3	**10/13/2016**	9:40	9:21	6:44		8:30	0.02	6:57	0.00
Week 3	**Day 1**	**10/18/2016**	13:20	13:02	16:18		14:51	0.12	7:16	0.01
	Day 2	**10/20/2016**	8:56	10:19	6:18	0.01	8:26	0.00	13:33	0.00
	Day 3	**10/21/2016**	7:05	6:48					6:48	0.00
Week 4	**Day 1**	**11/1/2016**	12:50	12:36	16:30	0.04	8:56	0.00	7:50	0.00
	Day 2	**11/2/2016**	12:01	11:41	7:01	0.00	8:42		15:26	0.00
	Day 3	**11/3/2016**	10:03	9:52	7:16	0.01	8:26	0.03	6:26	0.00
Week 5	**Day 1**	**11/8/2016**	10:57	10:47	15:39	0.00	8:44		7:34	0.00
	Day 2	**11/9/2016**	12:00	11:48	16:22	0.00	14:38	0.00	11:49	0.00
	Day 3	**11/10/2016**	9:31	9:13	6:56	0.00	8:22	0.00	7:51	0.00
Week 6	**Day 1**	**11/14/2016**	9:47	10:41	6:48	0.00	8:28	0.00	7:35	0.03
	Day 2	**11/15/2016**	10:09	9:59	7:44	0.00	9:10	0.00	12:25	0.00
	Day 3	**11/17/2016**	12:46	12:40	11:00	0.00	13:12	0.02	15:52	0.00
Week 7	**Day 1**	**11/21/2016**	11:29	11:21	7:58	0.00	9:22	0.00	12:50	0.03
	Day 2	**11/22/2016**	10:44	10:34	7:02	0.00	8:43	0.00	12:10	0.00
	Day 3	**11/23/2016**	10:34	10:14	6:57	0.00	8:26	0.00	11:56	0.00
Week 8	**Day 1**	**11/28/2016**	9:02	8:54	7:29	0.00	8:53	0.00	7:51	0.00
	Day 2	**11/30/2016**	8:55	8:56	7:17	0.00	8:44	0.00	7:25	0.00
	Day 3	**12/2/2016**	10:46	10:37	7:16	0.00	8:39	0.05	12:11	0.00
Week 9	**Day 1**	**12/5/2016**	8:46	8:39	7:28	0.00	8:49	0.00	7:12	0.00
	Day 2	**12/7/2016**	9:18	9:11	7:56	0.00	9:24	0.00	7:39	0.00
	Day 3	**12/9/2016**	11:24	11:16	7:52	0.00	9:12	0.00	12:54	
Week 10	**Day 1**	**12/12/2016**	9:18	9:10	7:42	0.00	9:04	0.00	7:51	0.00
	Day 2	**12/14/2016**	9:03	9:00	7:43	0.00	8:58	0.00	7:43	0.00
	Day 3	**12/16/2016**	11:32	11:19	7:47	0.00	9:01	0.00	13:10	0.00
Week 11	**Day 1**	**12/19/2016**	10:00	9:40	7:33	0.00	8:46	0.00	7:25	0.00
	Day 2	**12/20/2016**	10:42	10:27	12:34	0.00	14:03	0.00	7:27	0.00
	Day 3	**12/21/2016**	10:55	10:42	10:01	0.01	8:23	0.00	12:50	0.00
Week 12	**Day 1**	**12/27/2016**	11:08	11:00	11:10	0.03	12:21	0.00	7:34	0.00
	Day 2	**12/28/2016**	11:31	11:26	11:05	0.00	9:28	0.00	13:04	0.00
	Day 3	**12/29/2016**	11:16	11:08	10:45	0.01	9:00	0.00	7:33	0.00

Table B-4

SO_2 (Continued)

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection							
Maximum						0.08		0.12		0.03
Minimum						0.00		0.00		0.00
Average						0.01		0.01		0.00
Median						0.00		0.00		0.00
Range						0.08		0.12		0.03
Std. Deviation						0.02		0.03		0.01

Table B-4

SO_2 (Continued)

			Indoor				Avg.	Outdoor			
		Date	**Location**				**Indoor T**	**Time**	**Location**		
		Average	**Time**	**D**	**Time**	**E**	**hh:mm**	**hh:mm**	**A**	**Time**	**B**
Week 1	**Day 1**	**10/3/2016**	9:20		8:30	0.03	8:18	7:34	0.00	9:13	0.00
	Day 2	**10/5/2016**	14:20	0.02	12:23	0.02	12:07	7:42	0.00	15:07	0.00
	Day 3	**10/6/2016**	14:42	0.03	8:35	0.00	9:50	7:31	0.00	8:54	0.00
Week 2	**Day 1**	**10/10/2016**	9:03	0.02	8:34	0.04	8:16	7:12	0.00	9:14	0.00
	Day 2	**10/12/2016**	16:20	0.00	12:43	0.00	13:39	7:18	0.00	15:09	0.00
	Day 3	**10/13/2016**	16:14	0.01	8:24		9:58	7:31	0.00	8:52	0.00
Week 3	**Day 1**	**10/18/2016**	18:09	0.01	8:39	0.01	13:38	17:05	0.00	15:27	0.00
	Day 2	**10/20/2016**	14:58	0.00	8:23	0.01	7:32	7:05	0.00		
	Day 3	**10/21/2016**					7:23				
Week 4	**Day 1**	**11/1/2016**	14:42	0.00	15:05	0.01	13:03	16:54	0.00	9:21	0.00
	Day 2	**11/2/2016**	16:48	0.02	10:29	0.02	12:22	7:48	0.00	9:17	
	Day 3	**11/3/2016**	13:18	0.00	13:56	0.02	10:13	7:42	0.00	8:59	0.00
Week 5	**Day 1**	**11/8/2016**	10:31	0.00	11:31	0.02	11:07	16:03	0.00	9:19	0.00
	Day 2	**11/9/2016**	7:18	0.00	8:57	0.04	12:11	17:00	0.00	15:12	0.00
	Day 3	**11/10/2016**	12:46	0.00	10:11	0.00	9:50	7:30	0.00	9:05	0.00
Week 6	**Day 1**	**11/14/2016**	16:49	0.00	13:49	0.00	8:53	7:13	0.00	9:15	0.00
	Day 2	**11/15/2016**	9:45	0.00	10:53	0.01	10:19	8:10	0.00	9:44	0.00
	Day 3	**11/17/2016**	9:24	0.00	13:54	0.00	12:52	11:24	0.00	13:01	0.00
Week 7	**Day 1**	**11/21/2016**	15:26	0.00	11:13	0.03	11:37	8:24	0.00	10:08	0.00
	Day 2	**11/22/2016**	14:21	0.00	10:34	0.00	10:55	7:47	0.00	9:18	0.00
	Day 3	**11/23/2016**	13:32	0.00	10:23	0.00	10:54	7:34	0.00	9:00	0.00
Week 8	**Day 1**	**11/28/2016**	9:59	0.00	10:19	0.00	9:10	7:54	0.00	9:28	0.00
	Day 2	**11/30/2016**	11:06	0.00	10:08	0.01	8:54	7:42	0.00	9:17	0.00
	Day 3	**12/2/2016**	14:20	0.00	10:40	0.00	10:56	7:41	0.00	9:17	0.00
Week 9	**Day 1**	**12/5/2016**	9:36	0.00	10:14	0.04	8:54	7:52	0.00	9:24	0.00
	Day 2	**12/7/2016**	10:07	0.00	10:51	0.03	9:25	8:21	0.00	9:58	0.00
	Day 3	**12/9/2016**	15:05	0.00	11:21	0.01	11:32	8:17	0.00	9:47	0.00
Week 10	**Day 1**	**12/12/2016**	10:39	0.00	10:36		9:27	8:08	0.00	9:39	0.00
	Day 2	**12/14/2016**	10:28	0.00	10:10	0.01	9:07	8:05	0.00	9:23	0.00
	Day 3	**12/16/2016**	15:14	0.00	11:23	0.00	11:46	8:09	0.00	9:47	0.00
Week 11	**Day 1**	**12/19/2016**	14:18	0.00	10:18	0.00	10:21	7:53	0.00	9:21	0.00
	Day 2	**12/20/2016**	9:23	0.00	8:51	0.05	10:56	13:10	0.00	14:49	0.00
	Day 3	**12/21/2016**	11:01	0.00	11:18	0.00	11:08	10:26	0.00	9:10	0.00
Week 12	**Day 1**	**12/27/2016**	15:05	0.00	8:54	0.00	11:17	11:25	0.00	12:56	0.00
	Day 2	**12/28/2016**	15:31	0.00	8:04	0.00	11:37	11:12	0.00	10:01	0.00
	Day 3	**12/29/2016**	15:19	0.00	13:05	0.00	11:25	10:51	0.00	9:49	0.00

Table B-4

SO_2 (Continued)

			Indoor				Avg.	Outdoor			
		Date	Location				Indoor T	Time	Location		
		Average	Time	D	Time	E	hh:mm	hh:mm	A	Time	B
			Values after Chauvenet's Statistical Rejection								
Maximum				0.03		0.05			0.00		0.00
Minimum				0.00		0.00			0.00		0.00
Average				0.00		0.01			0.00		0.00
Median				0.00		0.01			0.00		0.00
Range				0.03		0.05			0.00		0.00
Std. Deviation				0.01		0.01			0.00		0.00

Table B-4

SO_2 (Continued)

			Outdoor					
		Date	Location					
		Average	Time	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	7:17	0.00	8:25	0.00	9:03	0.00
	Day 2	**10/5/2016**	11:12	0.00	13:31		13:06	
	Day 3	**10/6/2016**	7:34	0.00	15:30	0.00	9:44	0.00
Week 2	**Day 1**	**10/10/2016**	7:34	0.00	8:24	0.00	8:57	0.00
	Day 2	**10/12/2016**	15:13	0.00	16:58	0.00	13:39	0.00
	Day 3	**10/13/2016**	7:36	0.00	16:55	0.00	8:59	0.00
Week 3	**Day 1**	**10/18/2016**	7:41	0.00	18:46	0.00	9:14	0.00
	Day 2	**10/20/2016**	14:10	0.00	0:00	0.00	8:56	0.00
	Day 3	**10/21/2016**	7:23	0.00				
Week 4	**Day 1**	**11/1/2016**	8:25	0.00	15:21	0.00	15:16	0.00
	Day 2	**11/2/2016**	16:01	0.00	17:33	0.00	11:14	0.00
	Day 3	**11/3/2016**	7:02	0.00	12:56	0.00	14:30	0.00
Week 5	**Day 1**	**11/8/2016**	8:12	0.00	10:07	0.01	11:55	0.00
	Day 2	**11/9/2016**	11:22	0.00	7:54	0.00	9:30	0.00
	Day 3	**11/10/2016**	8:29	0.00	13:23	0.00	10:44	0.00
Week 6	**Day 1**	**11/14/2016**	8:12	0.00	5:25	0.00	14:24	0.00
	Day 2	**11/15/2016**	12:59	0.00	9:19	0.00	11:26	0.00
	Day 3	**11/17/2016**	16:36	0.00	8:28	0.00	14:51	0.00
Week 7	**Day 1**	**11/21/2016**	13:37	0.00	14:12	0.00	11:48	0.00
	Day 2	**11/22/2016**	12:43	0.00	13:31	0.00	11:20	0.00
	Day 3	**11/23/2016**	12:43	0.00	14:10	0.00	11:06	0.00
Week 8	**Day 1**	**11/28/2016**	8:26	0.00	9:12	0.00	10:54	0.00
	Day 2	**11/30/2016**	8:00	0.00	8:50	0.00	10:42	0.00
	Day 3	**12/2/2016**	12:46	0.00	13:35	0.00	11:24	0.00
Week 9	**Day 1**	**12/5/2016**	7:49	0.00	8:38	0.00	10:47	0.00
	Day 2	**12/7/2016**	8:17	0.00	9:06	0.00	11:25	0.00
	Day 3	**12/9/2016**	13:28	0.00	14:15	0.00	11:56	0.00
Week 10	**Day 1**	**12/12/2016**	8:30	0.00	9:34	0.00	11:25	0.00
	Day 2	**12/14/2016**	8:21	0.00	9:14	0.00	10:32	0.00
	Day 3	**12/16/2016**	13:59	0.00	14:47	0.00	12:10	0.00
Week 11	**Day 1**	**12/19/2016**	8:05	0.00	15:26	0.00	11:02	0.00
	Day 2	**12/20/2016**	8:15	0.00	8:55	0.00	9:35	0.00
	Day 3	**12/21/2016**	13:38	0.00	10:27	0.00	12:03	0.00
Week 12	**Day 1**	**12/27/2016**	8:11	0.00	14:15	0.00	9:38	0.00
	Day 2	**12/28/2016**	13:51	0.00	14:23	0.00	8:38	0.00
	Day 3	**12/29/2016**	8:21	0.00	14:27	0.00	13:39	0.00

Table B-4

SO_2 (Continued)

			Outdoor					
		Date	Location					
		Average	Time	C	Time	D	Time	E
			Values after Chauvenet's Statistical Reject					
Maximum				0.00		0.01		0.00
Minimum				0.00		0.00		0.00
Average				0.00		0.00		0.00
Median				0.00		0.00		0.00
Range				0.00		0.01		0.00
Std. Deviation				0.00		0.00		0.00

Table B-5

O_3

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**	8:12	7:56	6:31	0.000	8:47	0.000	6:36	0.000
	Day 2	**10/5/2016**	12:06	11:56	7:15	0.000	14:31	0.000	10:48	0.000
	Day 3	**10/6/2016**	9:26	9:10	6:32	0.000	8:09	0.000	7:20	0.000
Week 2	**Day 1**	**10/10/2016**	8:07	8:00	6:59	0.000	8:38	0.000	6:43	0.000
	Day 2	**10/12/2016**	13:23	13:08	6:42	0.000	14:56	0.000	14:25	0.000
	Day 3	**10/13/2016**	9:43	9:26	6:44	0.000	8:40	0.000	7:08	0.000
Week 3	**Day 1**	**10/18/2016**	13:21	13:02	16:18	0.000	15:02	0.000	7:06	0.000
	Day 2	**10/20/2016**	8:53	10:21	6:18	0.000	8:36	0.000	13:44	0.000
	Day 3	**10/21/2016**	7:16	6:59					6:59	0.000
Week 4	**Day 1**	**11/1/2016**	12:40	12:20	16:30	0.000	8:45	0.000	7:28	0.000
	Day 2	**11/2/2016**	11:51	11:37	7:01	0.000	8:31	0.000	15:16	0.000
	Day 3	**11/3/2016**	9:52	9:46	7:16	0.000	8:15	0.000	6:05	0.000
Week 5	**Day 1**	**11/8/2016**	10:51	10:40	15:39	0.000	8:34	0.000	7:23	0.000
	Day 2	**11/9/2016**	11:48	11:40	16:22	0.000	14:27	0.000	11:38	0.000
	Day 3	**11/10/2016**	9:20	9:04	6:56	0.000	8:11	0.000	7:39	0.000
Week 6	**Day 1**	**11/14/2016**	9:36	10:33	6:48	0.000	8:17	0.000	7:24	0.000
	Day 2	**11/15/2016**	9:58	9:51	7:44	0.000	9:00	0.000	12:14	0.000
	Day 3	**11/17/2016**	12:33	12:17	11:00	0.000	12:14	0.000	15:42	0.000
Week 7	**Day 1**	**11/21/2016**	11:16	11:12	7:58	0.000	9:11	0.000	12:39	0.000
	Day 2	**11/22/2016**	10:34	10:23	7:02	0.000	8:32	0.000	11:59	0.000
	Day 3	**11/23/2016**	10:21	10:03	6:57	0.000	8:15	0.000	11:45	0.000
Week 8	**Day 1**	**11/28/2016**	8:51	8:44	7:29	0.000	8:42	0.000	7:40	0.000
	Day 2	**11/30/2016**	8:39	8:43	7:17	0.000	8:33	0.000	7:15	0.000
	Day 3	**12/2/2016**	10:37	10:31	7:16	0.000	8:50	0.000	12:01	0.000
Week 9	**Day 1**	**12/5/2016**	8:35	8:25	7:28	0.000	8:08	0.000	7:01	0.000
	Day 2	**12/7/2016**	9:07	9:00	7:56	0.000	9:13	0.000	7:29	0.000
	Day 3	**12/9/2016**	11:14	11:07	7:52	0.000	9:01	0.000	12:44	0.000
Week 10	**Day 1**	**12/12/2016**	9:07	8:58	7:42	0.000	8:53	0.000	7:40	0.000
	Day 2	**12/14/2016**	8:57	8:54	7:43	0.000	8:48	0.000	7:54	0.000
	Day 3	**12/16/2016**	11:18	11:09	7:47	0.000	8:50	0.000	12:58	0.000
Week 11	**Day 1**	**12/19/2016**	9:50	9:31	7:33	0.000	8:35	0.000	7:14	0.000
	Day 2	**12/20/2016**	10:30	10:20	12:34	0.000	13:52	0.000	7:17	0.000
	Day 3	**12/21/2016**	10:50	10:34	10:01	0.000	8:17	0.000	12:40	0.000
Week 12	**Day 1**	**12/27/2016**	11:01	10:52	11:10	0.000	12:10	0.000	7:23	0.000
	Day 2	**12/28/2016**	11:24	11:17	11:05	0.000	9:17	0.000	12:53	0.000
	Day 3	**12/29/2016**	11:05	10:57	10:45	0.000	8:49	0.000	7:22	0.000

Table B-5

O_3 (Continued)

			Avg. Total	Avg.	Indoor					
		Date	Time	Indoor T	Time	Location				
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection							
Maximum						0.000		0.000		0.000
Minimum						0.000		0.000		0.000
Average						0.000		0.000		0.000
Median						0.000		0.000		0.000
Range						0.000		0.000		0.000
Std. Deviation						0.000		0.000		0.000

Table B-5

O_3 (Continued)

			Indoor				Avg.	Outdoor		
		Date	Location				Indoor T	Time	Location	
		Average	Time	D	Time	E	hh:mm	hh:mm	A	Time
Week 1	**Day 1**	**10/3/2016**	9:31	0.000	8:19	0.000	8:27	7:22	0.000	9:24
	Day 2	**10/5/2016**	14:37	0.000	12:33	0.000	12:16	7:29	0.006	15:29
	Day 3	**10/6/2016**	14:53	0.000	8:57	0.000	9:42	7:04	0.000	9:04
Week 2	**Day 1**	**10/10/2016**	9:21	0.000	8:23	0.000	8:14	7:04	0.000	9:03
	Day 2	**10/12/2016**	16:32	0.000	13:05	0.000	13:38	6:51	0.000	15:31
	Day 3	**10/13/2016**	16:26	0.000	8:13	0.000	10:01	7:13	0.000	9:13
Week 3	**Day 1**	**10/18/2016**	17:58	0.000	8:50	0.000	13:39	16:46	0.038	15:37
	Day 2	**10/20/2016**	15:09	0.000	8:01	0.000	7:25	6:45	0.018	
	Day 3	**10/21/2016**					7:34			
Week 4	**Day 1**	**11/1/2016**	14:18	0.000	14:42	0.000	12:59	16:35	0.027	9:42
	Day 2	**11/2/2016**	16:37	0.000	10:40	0.000	12:06	7:30	0.006	9:06
	Day 3	**11/3/2016**	13:30	0.000	13:45	0.000	9:59	7:23	0.000	8:49
Week 5	**Day 1**	**11/8/2016**	10:24	0.000	11:21	0.000	11:02	15:45	0.029	9:08
	Day 2	**11/9/2016**	7:07	0.000	8:46	0.000	11:57	16:31	0.026	15:01
	Day 3	**11/10/2016**	12:35	0.000	10:01	0.000	9:36	7:12	0.021	8:44
Week 6	**Day 1**	**11/14/2016**	16:39	0.000	13:38	0.000	8:39	6:55	0.000	8:53
	Day 2	**11/15/2016**	9:34	0.000	10:43	0.000	10:05	7:52	0.002	9:34
	Day 3	**11/17/2016**	8:47	0.000	13:43	0.000	12:50	12:41	0.045	12:50
Week 7	**Day 1**	**11/21/2016**	15:14	0.000	11:01	0.000	11:21	8:06	0.034	9:46
	Day 2	**11/22/2016**	13:58	0.000	10:24	0.000	10:45	7:48	0.000	9:07
	Day 3	**11/23/2016**	13:10		10:12	0.000	10:39	7:22	0.031	8:50
Week 8	**Day 1**	**11/28/2016**	9:41	0.000	10:08	0.000	8:58	7:34	0.003	9:17
	Day 2	**11/30/2016**	10:37	0.000	9:57	0.000	8:34	7:23	0.000	9:07
	Day 3	**12/2/2016**	14:01	0.000	10:29	0.000	10:43	7:31	0.020	9:06
Week 9	**Day 1**	**12/5/2016**	9:02	0.000	10:30	0.000	8:45	7:53	0.008	9:13
	Day 2	**12/7/2016**	9:43	0.000	10:41	0.000	9:15	8:11	0.020	9:47
	Day 3	**12/9/2016**	14:51	0.000	11:10	0.000	11:21	8:02	0.025	9:36
Week 10	**Day 1**	**12/12/2016**	10:14	0.000	10:25	0.000	9:15	8:07	0.025	9:28
	Day 2	**12/14/2016**	10:08	0.000	10:00	0.000	8:59	7:52	0.010	9:15
	Day 3	**12/16/2016**	15:02	0.000	11:12	0.000	11:27	8:00	0.000	9:26
Week 11	**Day 1**	**12/19/2016**	14:06	0.000	10:08	0.000	10:09	7:47	0.000	9:10
	Day 2	**12/20/2016**	9:19	0.000	8:40	0.000	10:39	12:47	0.033	14:27
	Day 3	**12/21/2016**	10:47	0.000	11:07	0.000	11:06			8:59
Week 12	**Day 1**	**12/27/2016**	14:54	0.000	8:43	0.000	11:11	11:19	0.018	12:45
	Day 2	**12/28/2016**	15:19	0.000	7:53	0.000	11:31	11:19	0.000	9:51
	Day 3	**12/29/2016**	14:55	0.000	12:54	0.000	11:13	10:53	0.031	9:28

Table B-5

O_3 (Continued)

			Indoor				Avg.	Outdoor		
		Date	Location				Indoor T	Time	Location	
		Average	Time	D	Time	E	hh:mm	hh:mm	A	Time
			Values after Chauvenet's Statistical Rejection							
Maximum				0.000		0.000			0.045	
Minimum				0.000		0.000			0.000	
Average				0.000		0.000			0.014	
Median				0.000		0.000			0.009	
Range				0.000		0.000			0.045	
Std. Deviation				0.000		0.000			0.014	

Table B-5

O_3 (Continued)

			Outdoor						
		Date	Location						
		Average	B	Time	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	0.000	7:39	0.002	8:35	0.000	9:16	0.007
	Day 2	**10/5/2016**	0.006	11:35	0.016	13:55	0.007	12:53	0.005
	Day 3	**10/6/2016**	0.016	7:56		15:19	0.008	9:10	0.020
Week 2	**Day 1**	**10/10/2016**	0.000	7:23	0.000	8:35	0.000	9:08	0.008
	Day 2	**10/12/2016**	0.009	15:24	0.000	17:09	0.000	13:16	0.018
	Day 3	**10/13/2016**	0.000	7:46	0.000	17:05	0.024	8:48	0.002
Week 3	**Day 1**	**10/18/2016**	0.021	7:52	0.003	18:58	0.004	9:03	0.018
	Day 2	**10/20/2016**		14:21	0.016	0:00	0.000	8:36	0.004
	Day 3	**10/21/2016**		7:34	0.000				
Week 4	**Day 1**	**11/1/2016**	0.000	8:04	0.009	14:59	0.031	15:38	0.027
	Day 2	**11/2/2016**	0.000	15:51	0.000	17:11	0.016	10:52	0.016
	Day 3	**11/3/2016**	0.000	6:41	0.000	12:45	0.012	14:19	0.009
Week 5	**Day 1**	**11/8/2016**	0.002	8:01	0.017	10:00	0.011	12:16	0.023
	Day 2	**11/9/2016**	0.023	11:12	0.002	7:44	0.000	9:20	0.015
	Day 3	**11/10/2016**	0.013	8:18	0.031	13:13	0.019	10:34	0.026
Week 6	**Day 1**	**11/14/2016**	0.004	8:02	0.009	5:14	0.000	14:13	0.007
	Day 2	**11/15/2016**	0.003	12:48	0.012	8:58	0.002	11:16	0.011
	Day 3	**11/17/2016**	0.016	16:15	0.007	8:06	0.032	14:19	0.029
Week 7	**Day 1**	**11/21/2016**	0.041	13:15	0.027	14:01	0.041	11:37	0.036
	Day 2	**11/22/2016**	0.013	12:32	0.036	13:20		10:58	
	Day 3	**11/23/2016**	0.023	12:21	0.015	13:58	0.000	10:45	0.016
Week 8	**Day 1**	**11/28/2016**	0.015	8:15	0.014	9:02	0.019	10:43	0.016
	Day 2	**11/30/2016**	0.000	7:50	0.000	8:03	0.000	10:31	0.001
	Day 3	**12/2/2016**	0.016	12:35	0.032	13:24	0.021	11:03	0.030
Week 9	**Day 1**	**12/5/2016**	0.012	7:38	0.012	8:27	0.008	10:37	0.000
	Day 2	**12/7/2016**	0.021	8:06	0.000	8:56	0.000	11:15	0.025
	Day 3	**12/9/2016**	0.034	13:18	0.048	14:05	0.032	11:45	0.037
Week 10	**Day 1**	**12/12/2016**	0.022	8:19	0.011	9:11	0.002	11:12	0.021
	Day 2	**12/14/2016**	0.008	8:10	0.000	9:03	0.000	10:37	
	Day 3	**12/16/2016**	0.000	13:37	0.007	14:24	0.027	11:49	0.003
Week 11	**Day 1**	**12/19/2016**	0.026	7:55	0.021	15:05	0.036	10:51	0.016
	Day 2	**12/20/2016**	0.030	7:54	0.000	8:45	0.000	9:25	0.000
	Day 3	**12/21/2016**	0.023	13:28	0.033	10:06	0.000	11:52	0.026
Week 12	**Day 1**	**12/27/2016**	0.022	8:00	0.020	14:26	0.032	9:27	0.028
	Day 2	**12/28/2016**	0.005	13:29	0.027	14:12	0.026	8:48	0.001
	Day 3	**12/29/2016**	0.036	8:00	0.032	14:16	0.020	13:28	0.034

Table B-5

O_3 (Continued)

			Outdoor						
		Date	Location						
		Average	B	Time	C	Time	D	Time	E
			Values after Chauvenet's Statisctical Rejection						
Maximum			0.041		0.048		0.041		0.037
Minimum			0.000		0.000		0.000		0.000
Average			0.014		0.013		0.013		0.016
Median			0.013		0.011		0.008		0.016
Range			0.041		0.048		0.041		0.037
Std. Deviation			0.012		0.013		0.013		0.011

Table B-6

CO

			Avg. Total	Avg.	Indoor							
		Date	Time	Indoor T	Time	Location						
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time	D
Week 1	**Day 1**	**10/3/2016**	7:55	7:44	6:34	0	8:30	0	6:34	0	8:54	0
	Day 2	**10/5/2016**	11:44	11:34	6:49	0	14:23	0	10:31	0	14:02	0
	Day 3	**10/6/2016**	8:59	8:32	6:29	0	8:01	0	6:50	0	12:55	0
Week 2	**Day 1**	**10/10/2016**	7:46	7:35	6:29	0	8:07	0	6:29	0	8:51	0
	Day 2	**10/12/2016**	12:59	12:40	6:14	0	14:25	0	14:16	0	15:53	0
	Day 3	**10/13/2016**	9:23	9:13	6:38	0	8:09	0	6:40	0	16:37	0
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09	0	14:31	0	7:01	0	17:47	0
	Day 2	**10/20/2016**	10:18	10:00	6:11	0	8:07	0	13:14	0	14:39	0
	Day 3	**10/21/2016**	6:48	6:29					6:29	0		
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	0	8:36	0	7:22	0	14:37	0
	Day 2	**11/2/2016**	11:41	11:24	6:53	0	8:21	0	15:09	0	16:30	0
	Day 3	**11/3/2016**	9:40	9:31	6:46	0	8:07	0	6:06	0	13:00	0
Week 5	**Day 1**	**11/8/2016**	10:39	10:28	15:10	0	8:23	0	7:14	0	10:20	0
	Day 2	**11/9/2016**	11:46	11:29	15:52	0	14:19	0	11:36	0	7:02	0
	Day 3	**11/10/2016**	9:08	8:49	6:26	0	8:03	0	7:31	0	12:17	0
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	0	8:07	0	7:15	0	16:45	0
	Day 2	**11/15/2016**	9:49	9:38	7:15	0	8:52	0	12:05	0	9:26	0
	Day 3	**11/17/2016**	12:14	12:04	10:31	0	12:04	0	15:33	0	8:40	0
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	0	9:14	0	12:55	0	15:29	0
	Day 2	**11/22/2016**	10:50	10:50	7:15	0	8:45	0	12:10	0	15:29	0
	Day 3	**11/23/2016**	10:21	10:17	6:55	0	8:22	0	11:56	0	13:50	0
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	0	8:55	0	7:52	0	10:01	0
	Day 2	**11/30/2016**	8:55	8:52	7:09	0	8:48	0	7:27	0	10:40	0
	Day 3	**12/2/2016**	10:43	10:36	7:07	0	8:43	0	12:11	0	14:22	0
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	0	8:52	0	7:13	0	9:50	0
	Day 2	**12/7/2016**	9:11	9:12	7:49	0	9:24	0	7:45	0	10:09	0
	Day 3	**12/9/2016**	11:21	11:17	7:42	0	9:13	0	12:55	0	15:14	0
Week 10	**Day 1**	**12/12/2016**	9:13	9:10	7:32	0	9:05	0	7:55	0	10:44	0
	Day 2	**12/14/2016**	8:51	8:37	7:33	0	9:00	0	7:47	0	10:09	0
	Day 3	**12/16/2016**	11:15	11:19	7:37	0	9:00	0	13:12	0	15:15	0
Week 11	**Day 1**	**12/19/2016**	9:58	9:38	7:24	0	8:47	0	7:25	0	14:19	0
	Day 2	**12/20/2016**	10:36	10:30	12:22	0	14:03	0	7:28	0	9:43	0
	Day 3	**12/21/2016**	10:47	10:44	9:52	0	8:23	0	12:59	0	11:11	0
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	0	12:19	0	7:36	0	15:07	0
	Day 2	**12/28/2016**	11:26	11:21	10:54	0	9:28	0	13:01	0	15:20	0
	Day 3	**12/29/2016**	11:10	11:06	10:36	0	9:03	0	7:31	0	15:20	0

Table B-6

CO (Continued)

			Avg. Total	Avg.	Indoor							
		Date	Time	Indoor T	Time	Location						
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time	D
			Values after Chauvenet's Statistical Rejection									
Maximum						0		0		0		0
Minimum						0		0		0		0
Average						0		0		0		0
Median						0		0		0		0
Range						0		0		0		0
Std. Deviation						0		0		0		0

Table B-6

CO (Continued)

			Indoor		Avg.	Outdoor									
		Date	Location		Indoor T	Time	Location								
		Average	Time	E	hh:mm	hh:mm	A	Time	B	Time	C	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	8:11	0	8:07	7:08	0	9:09	0	7:11	0	8:21	0	8:47	0
	Day 2	**10/5/2016**	12:06	0	11:54	7:21	0	14:59	0	11:08	0	13:25	0	12:39	0
	Day 3	**10/6/2016**	8:29	0	9:26	7:01	0	8:39	0	7:30	0	15:01	0	9:02	0
Week 2	**Day 1**	**10/10/2016**	8:02	0	7:56	7:05	0	8:40	0	7:05	0	8:15	0	8:37	0
	Day 2	**10/12/2016**	12:35	0	13:18	6:49	0	15:05	0	14:51	0	16:37	0	13:08	0
	Day 3	**10/13/2016**	8:05	0	9:33	7:11	0	8:44	0	7:18	0	15:56	0	8:39	0
Week 3	**Day 1**	**10/18/2016**	8:20	0	13:21	16:46	0	15:07	0	7:35	0	18:26	0	8:54	0
	Day 2	**10/20/2016**	7:52	0	10:36	6:46	0	8:41	0	13:52	0	15:14	0	8:27	0
	Day 3	**10/21/2016**			7:07					7:07	0				
Week 4	**Day 1**	**11/1/2016**	14:34	0	12:45	16:37	0	9:14	0	7:55	0	14:50	0	15:09	0
	Day 2	**11/2/2016**	10:09	0	11:59	7:31	0	8:57	0	15:42	0	17:04	0	10:43	0
	Day 3	**11/3/2016**	13:37	0	9:50	7:25	0	8:40	0	6:32	0	12:27	0	14:09	0
Week 5	**Day 1**	**11/8/2016**	11:13	0	10:51	15:44	0	9:00	0	7:53	0	9:55	0	11:47	0
	Day 2	**11/9/2016**	8:37	0	12:03	16:30	0	14:54	0	12:04	0	7:35	0	9:13	0
	Day 3	**11/10/2016**	9:50	0	9:27	7:03	0	8:37	0	8:08	0	13:04	0	10:27	0
Week 6	**Day 1**	**11/14/2016**	13:29	0	11:09	6:55	0	8:47	0	7:54	0	18:05	0	14:06	0
	Day 2	**11/15/2016**	10:33	0	10:01	7:51	0	9:27	0	12:52	0	8:49	0	11:07	0
	Day 3	**11/17/2016**	13:34	0	12:24	11:06	0	12:42	0	16:09	0	7:57	0	14:09	0
Week 7	**Day 1**	**11/21/2016**	11:03	0	11:24	8:09	0	9:40	0	13:18	0	14:10	0	11:43	0
	Day 2	**11/22/2016**	10:35	0	10:50	7:49	0	9:19	0	12:44	0	13:10	0	11:10	0
	Day 3	**11/23/2016**	10:24	0	10:26	7:23	0	8:46	0	12:18	0	13:03	0	10:42	0
Week 8	**Day 1**	**11/28/2016**	10:20	0	9:01	7:44	0	9:19	0	8:18	0	9:00	0	10:44	0
	Day 2	**11/30/2016**	10:17	0	8:58	7:33	0	10:05	0	7:54	0	8:40	0	10:40	0
	Day 3	**12/2/2016**	10:41	0	10:49	7:42	0	9:16	0	12:45	0	13:18	0	11:07	0
Week 9	**Day 1**	**12/5/2016**	10:16	0	8:52	7:53	0	9:24	0	7:50	0	8:30	0	10:46	0
	Day 2	**12/7/2016**	10:55	0	9:11	7:21	0	10:00	0	8:20	0	8:58	0	11:17	0
	Day 3	**12/9/2016**	11:22	0	11:26	8:16	0	9:45	0	13:22	0	13:59	0	11:50	0
Week 10	**Day 1**	**12/12/2016**	10:38	0	9:15	8:09	0	9:41	0	8:25	0	9:00	0	11:03	0
	Day 2	**12/14/2016**		0	9:05	8:06	0	9:20	0	8:25	0	9:00	0	10:34	0
	Day 3	**12/16/2016**	11:34	0	11:11	8:05	0		0	13:38	0		0	11:52	0
Week 11	**Day 1**	**12/19/2016**	10:19	0	10:17	7:52	0	9:20	0	8:10	0	15:10	0	10:55	0
	Day 2	**12/20/2016**	8:58	0	10:42	12:54	0	14:40	0	7:59	0	8:41	0	9:18	0
	Day 3	**12/21/2016**	11:19	0	10:50	10:17	0	8:45	0	13:18	0	10:08	0	11:43	0
Week 12	**Day 1**	**12/27/2016**	8:54	0	11:11	11:25	0	12:54	0	8:03	0	14:09	0	9:25	0
	Day 2	**12/28/2016**	8:06	0	11:31	11:20	0	10:00	0	13:31	0	14:16	0	8:30	0
	Day 3	**12/29/2016**	13:01	0	11:14	10:58	0	9:32	0	8:00	0	14:13	0	13:30	0

Table B-6

CO (Continued)

			Indoor		Avg.	Outdoor									
		Date	Location		Indoor T	Time	Location								
		Average	Time	E	hh:mm	hh:mm	A	Time	B	Time	C	Time	D	Time	E
			Values after Chauvenet's Statistical Rejection												
Maximum				0			0		0		0		0		0
Minimum				0			0		0		0		0		0
Average				0			0		0		0		0		0
Median				0			0		0		0		0		0
Range				0			0		0		0		0		0
Std. Deviation				0			0		0		0		0		0

Table B-7

CO_2

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:55	7:44	6:34	653	8:30	569	6:34	453	8:54
	Day 2	**10/5/2016**	11:44	11:34	6:49	576	14:23	655	10:31	643	14:02
	Day 3	**10/6/2016**	9:00	8:33	6:29	530	8:01	502	6:50	478	12:55
Week 2	**Day 1**	**10/10/2016**	7:46	7:35	6:29	605	8:07	535	6:29	743	8:51
	Day 2	**10/12/2016**	12:59	12:40	6:14	534	14:25	524	14:16		15:53
	Day 3	**10/13/2016**	9:23	9:13	6:38	620	8:09	665	6:40	522	16:37
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09	807	14:31	657	7:01	463	17:47
	Day 2	**10/20/2016**	10:18	10:00	6:11	625	8:07	674	13:14	697	14:39
	Day 3	**10/21/2016**	6:48	6:29					6:29	499	
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	748	8:36	622	7:22	525	14:37
	Day 2	**11/2/2016**	11:41	11:24	6:53	555	8:21	853	15:09	618	16:30
	Day 3	**11/3/2016**	9:40	9:31	6:46	630	8:07	713	6:06	586	13:00
Week 5	**Day 1**	**11/8/2016**	10:39	10:28	15:10	606	8:23	866	7:14	560	10:20
	Day 2	**11/9/2016**	11:46	11:29	15:52	683	14:19	657	11:36	539	7:02
	Day 3	**11/10/2016**	9:08	8:49	6:26	512	8:03	608	7:31	533	12:17
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	576	8:07	567	7:15	518	16:45
	Day 2	**11/15/2016**	9:49	9:38	7:15	604	8:52	628	12:05	693	9:26
	Day 3	**11/17/2016**	12:14	12:04	10:31	632	12:04		15:33	703	8:40
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	452	9:14	619	12:55	555	15:29
	Day 2	**11/22/2016**	10:50	10:50	7:15	523	8:45	618	12:10	572	15:29
	Day 3	**11/23/2016**	10:21	10:17	6:55	407	8:22	584	11:56	507	13:50
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	418	8:55	480	7:52	491	10:01
	Day 2	**11/30/2016**	8:55	8:52	7:09	415	8:48	545	7:27	501	10:40
	Day 3	**12/2/2016**	10:43	10:36	7:07	457	8:43	514	12:11	566	14:22
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	420	8:52	541	7:13	442	9:50
	Day 2	**12/7/2016**	9:11	9:12	7:49	680	9:24	610	7:45	469	10:09
	Day 3	**12/9/2016**	11:21	11:17	7:42	474	9:13	661	12:55	701	15:14
Week 10	**Day 1**	**12/12/2016**	9:13	9:10	7:32	683	9:05	649	7:55	550	10:44
	Day 2	**12/14/2016**	8:51	8:37	7:33	494	9:00	583	7:47	472	10:09
	Day 3	**12/16/2016**	11:02	11:19	7:37	473	9:00	745	13:12	642	15:15
Week 11	**Day 1**	**12/19/2016**	9:58	9:38	7:24	487	8:47	664	7:25	403	14:19
	Day 2	**12/20/2016**	10:36	10:30	12:22	747	14:03	703	7:28	440	9:43
	Day 3	**12/21/2016**	10:47	10:44	9:52	455	8:23	457	12:59	457	11:11
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	507	12:19	492	7:36	388	15:07
	Day 2	**12/28/2016**	11:26	11:21	10:54	509	9:28	594	13:01	444	15:20
	Day 3	**12/29/2016**	11:10	11:06	10:36	565	9:03	494	7:31	382	15:20

Table B-7

CO_2 (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						807		866		743	
Minimum						407		457		382	
Average						562		613		536	
Median						555		614		522	
Range						400		409		361	
Std. Deviation						102		94		94	

Table B-7

CO_2 (Continued)

			Indoor			Avg.	Outdoor						
		Date	Location			Indoor T	Time	Location					
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	591	8:11	647	8:07	7:08	471	9:09	444	7:11	432	8:21
	Day 2	**10/5/2016**	870	12:06	619	11:54	7:21	433	14:59	436	11:08	431	13:25
	Day 3	**10/6/2016**	724			9:26	7:01	447	8:39	433	7:30	429	15:01
Week 2	**Day 1**	**10/10/2016**	516	8:02	611	7:56	7:05		8:40	443	7:05	450	8:15
	Day 2	**10/12/2016**	554	12:35	526	13:18	6:49	444	15:05	422	14:51	429	16:37
	Day 3	**10/13/2016**	851	8:05	681	9:33	7:11		8:44	444	7:18	441	15:56
Week 3	**Day 1**	**10/18/2016**	775	8:20	529	13:21	16:46	337	15:07	413	7:35	424	18:26
	Day 2	**10/20/2016**	541	7:52	519	10:36	6:46	429	8:41	435	13:52	426	15:14
	Day 3	**10/21/2016**				7:07					7:07	433	
Week 4	**Day 1**	**11/1/2016**	538	14:34	738	12:45	16:37	427	9:14		7:55	440	14:50
	Day 2	**11/2/2016**	804	10:09	728	11:59	7:31	511	8:57	471	15:42	458	17:04
	Day 3	**11/3/2016**	660	13:37	630	9:50	7:25	479	8:40		6:32	448	12:27
Week 5	**Day 1**	**11/8/2016**	812	11:13	642	10:51	15:44	423	9:00	448	7:53	440	9:55
	Day 2	**11/9/2016**	544	8:37	642	12:03	16:30	417	14:54	413	12:04	430	7:35
	Day 3	**11/10/2016**	608	9:50	561	9:27	7:03	433	8:37	435	8:08	436	13:04
Week 6	**Day 1**	**11/14/2016**	681	13:29	686	11:09	6:55	432	8:47	438	7:54		18:05
	Day 2	**11/15/2016**	648	10:33	635	10:01	7:51	472	9:27	434	12:52	434	8:49
	Day 3	**11/17/2016**	525	13:34	563	12:24	11:06	437	12:42	449	16:09	438	7:57
Week 7	**Day 1**	**11/21/2016**	620	11:03	787	11:24	8:09	410	9:40	397	13:18	410	14:10
	Day 2	**11/22/2016**	659	10:35	728	10:50	7:49	472	9:19	399	12:44	398	13:10
	Day 3	**11/23/2016**	760	10:24	476	10:26	7:23	389	8:46	422	12:18	421	13:03
Week 8	**Day 1**	**11/28/2016**	664	10:20	509	9:01	7:44	397	9:19	388	8:18	395	9:00
	Day 2	**11/30/2016**	691	10:17	520	8:58	7:33	399	10:05	402	7:54	434	8:40
	Day 3	**12/2/2016**		10:41	620	10:49	7:42	412	9:16	406	12:45	395	13:18
Week 9	**Day 1**	**12/5/2016**	667	10:16	705	8:52	7:53	402	9:24	393	7:50	411	8:30
	Day 2	**12/7/2016**	694	10:55	638	9:11	7:21	400	10:00	402	8:20	403	8:58
	Day 3	**12/9/2016**	692	11:22	634	11:26	8:16	407	9:45	403	13:22	398	13:59
Week 10	**Day 1**	**12/12/2016**	769	10:38	746	9:15	8:09	419	9:41	406	8:25	406	9:00
	Day 2	**12/14/2016**	678		615	9:05	8:06	406	9:20	408	8:25	410	9:00
	Day 3	**12/16/2016**	895	11:34	733	10:46	8:05	417	9:30	409	13:38	406	
Week 11	**Day 1**	**12/19/2016**	1009	10:19	652	10:17	7:52	427	9:20	431	8:10	418	15:10
	Day 2	**12/20/2016**	612	8:58	643	10:42	12:54	392	14:40	391	7:59	432	8:41
	Day 3	**12/21/2016**	892	11:19	664	10:50	10:17	391	8:45	400	13:18	395	10:08
Week 12	**Day 1**	**12/27/2016**	683	8:54	562	11:11	11:25	395	12:54	393	8:03	390	14:09
	Day 2	**12/28/2016**	555	8:06	655	11:31	11:20	407	10:00	414	13:31	372	14:16
	Day 3	**12/29/2016**	728	13:01	620	11:14	10:58	389	9:32	390	8:00	391	14:13

Table B-7

CO_2 (Continued)

			Indoor			Avg.	Outdoor						
		Date	Location			Indoor T	Time	Location					
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chanvenet's Statistical Rejection										
Maximum			1009		787			511		471		458	
Minimum			516		476			337		388		372	
Average			691		631			422		419		420	
Median			680		637			417		413		426	
Range			493		311			174		83		86	
Std. Deviation			119		75			33		21		20	

Table B-7

CO_2 (Continued)

			Outdoor		
		Date	Location		
		Average	D	Time	E
Week 1	**Day 1**	**10/3/2016**	464	8:47	436
	Day 2	**10/5/2016**	424	12:39	424
	Day 3	**10/6/2016**	414	9:02	430
Week 2	**Day 1**	**10/10/2016**	453	8:37	455
	Day 2	**10/12/2016**	419	13:08	426
	Day 3	**10/13/2016**	429	8:39	447
Week 3	**Day 1**	**10/18/2016**	422	8:54	426
	Day 2	**10/20/2016**	434	8:27	428
	Day 3	**10/21/2016**			
Week 4	**Day 1**	**11/1/2016**	431	15:09	425
	Day 2	**11/2/2016**	448	10:43	447
	Day 3	**11/3/2016**	428	14:09	450
Week 5	**Day 1**	**11/8/2016**	433	11:47	433
	Day 2	**11/9/2016**	448	9:13	436
	Day 3	**11/10/2016**	430	10:27	432
Week 6	**Day 1**	**11/14/2016**	475	14:06	438
	Day 2	**11/15/2016**	438	11:07	463
	Day 3	**11/17/2016**	396	14:09	420
Week 7	**Day 1**	**11/21/2016**	407	11:43	410
	Day 2	**11/22/2016**	391	11:10	395
	Day 3	**11/23/2016**	406	10:42	400
Week 8	**Day 1**	**11/28/2016**	391	10:44	382
	Day 2	**11/30/2016**	400	10:40	397
	Day 3	**12/2/2016**	402	11:07	389
Week 9	**Day 1**	**12/5/2016**	405	10:46	395
	Day 2	**12/7/2016**	404	11:17	400
	Day 3	**12/9/2016**	389	11:50	397
Week 10	**Day 1**	**12/12/2016**	400	11:03	406
	Day 2	**12/14/2016**	403	10:34	405
	Day 3	**12/16/2016**	394	11:52	414
Week 11	**Day 1**	**12/19/2016**	404	10:55	397
	Day 2	**12/20/2016**	399	9:18	427
	Day 3	**12/21/2016**	436	11:43	398
Week 12	**Day 1**	**12/27/2016**	388	9:25	400
	Day 2	**12/28/2016**	380	8:30	413
	Day 3	**12/29/2016**	382	13:30	383

Table B-7

CO_2 (Continued)

			Outdoor		
		Date	Location		
		Average	D	Time	E
			Values after Ch		
Maximum			475		463
Minimum			380		382
Average			416		418
Median			407		420
Range			95		81
Std. Deviation			24		21

Table B-8

TA

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:39	7:12	6:34	68.4	8:30	72.1	6:34	73.0	
	Day 2	**10/5/2016**	11:44	11:34	6:49	70.5	14:23	72.1	10:31	72.3	14:02
	Day 3	**10/6/2016**	8:59	8:32	6:29	71.4	8:01	71.2	6:50	72.0	12:55
Week 2	**Day 1**	**10/10/2016**	7:36	7:16	6:29	68.5	8:07	71.4	6:29	72.7	
	Day 2	**10/12/2016**	12:59	12:40	6:14	70.3	14:25	68.7	14:16	69.8	15:53
	Day 3	**10/13/2016**	9:45	9:58	6:38	66.4			6:40	68.5	16:37
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09		14:31	73.8	7:01	71.2	17:47
	Day 2	**10/20/2016**	10:34	10:32	6:11	68.5	8:07	68.7	13:14	68.9	14:39
	Day 3	**10/21/2016**	6:48	6:29					6:29	66.9	
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	74.1	8:36	69.6	7:22	70.0	14:37
	Day 2	**11/2/2016**	11:41	11:24	6:53	68.7	8:21	69.4	15:09	70.3	16:30
	Day 3	**11/3/2016**	9:40	9:31	6:46	66.7	8:07	69.1	6:06	66.0	13:00
Week 5	**Day 1**	**11/8/2016**	10:55	10:59	15:10	70.5			7:14	72.7	10:20
	Day 2	**11/9/2016**	12:59	13:55	15:52	71.2	14:19	74.3	11:36	70.5	
	Day 3	**11/10/2016**	9:01	8:34	6:26	67.3	8:03	68.7	7:31	67.8	12:17
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	68.5	8:07	69.3	7:15	67.3	16:45
	Day 2	**11/15/2016**	9:51	9:42			8:52	70.0			
	Day 3	**11/17/2016**	12:14	12:04	10:31	68.5	12:04	74.7	15:33	73.2	8:40
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	67.5	9:14	73.0	12:55	72.3	15:29
	Day 2	**11/22/2016**	10:50	10:50	7:15	68.4	8:45	74.8	12:10	71.1	15:29
	Day 3	**11/23/2016**	10:21	10:17	6:55	67.8	8:22	74.7	11:56	72.3	13:50
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	68.5	8:55	75.4	7:52	71.4	10:01
	Day 2	**11/30/2016**	8:55	8:52	7:09	68.2	8:48	75.4	7:27	72.3	10:40
	Day 3	**12/2/2016**	10:43	10:36	7:07	67.8	8:43	74.7	12:11	71.2	14:22
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	68.5	8:52	75.0	7:13	71.2	9:50
	Day 2	**12/7/2016**	9:11	9:12	7:49	67.6	9:24	74.1	7:45	69.8	10:09
	Day 3	**12/9/2016**	11:21	11:17	7:42	67.3	9:13	73.6	12:55	70.0	15:14
Week 10	**Day 1**	**12/12/2016**	9:13	9:10	7:32	67.5	9:05	73.8	7:55	71.8	10:44
	Day 2	**12/14/2016**	9:01	8:58			9:00	70.0	7:47	71.4	10:09
	Day 3	**12/16/2016**	11:02	11:19	7:37	66.9	9:00	70.9	13:12	70.2	15:15
Week 11	**Day 1**	**12/19/2016**	9:58	9:38	7:24	66.0	8:47	69.4	7:25	71.2	14:19
	Day 2	**12/20/2016**	10:36	10:30	12:22	70.3	14:03	71.6	7:28	72.1	9:43
	Day 3	**12/21/2016**	10:47	10:44	9:52	68.4	8:23	73.0	12:59	71.8	11:11
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	68.5	12:19	73.6	7:36	72.1	15:07
	Day 2	**12/28/2016**	11:26	11:21	10:54	68.7	9:28	72.3	13:01	72.3	15:20
	Day 3	**12/29/2016**	11:10	11:06	10:36	68.2	9:03	72.1	7:31	72.3	15:20

Table B-8

TA (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						74.1		75.4		73.2	
Minimum						66.0		68.7		66.0	
Average						68.6		72.1		70.9	
Median						68.5		72.1		71.2	
Range						8.1		6.7		7.2	
Std. Deviation						1.6		2.2		1.8	

Table B-8

TA (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	Day 1	10/3/2016				8:07	7:08	53.4	9:09	66.4	7:11	63.0
	Day 2	10/5/2016	74.5	12:06	74.1	11:54	7:21	65.7	14:59	68.4	11:08	72.9
	Day 3	10/6/2016	73.0	8:29	69.6	9:26	7:01	66.4	8:39	67.1	7:30	66.4
Week 2	Day 1	10/10/2016		8:02	66.4	7:56	7:05	45.0	8:40	66.6	7:05	63.0
	Day 2	10/12/2016	71.8	12:35	70.5	13:18	6:49	59.5	15:05	39.9	14:51	56.8
	Day 3	10/13/2016	73.8			9:33	7:11	53.8	8:44	52.5	7:18	41.7
Week 3	Day 1	10/18/2016	74.5	8:20	72.0	13:21	16:46	70.2	15:07	79.3	7:35	70.5
	Day 2	10/20/2016	68.9			10:36	6:46	51.1	8:41	51.1	13:52	56.8
	Day 3	10/21/2016				7:07					7:07	45.0
Week 4	Day 1	11/1/2016	74.5	14:34	73.0	12:45	16:37	72.0	9:14	59.4	7:55	51.3
	Day 2	11/2/2016	70.5	10:09	73.8	11:59	7:31	55.9	8:57	57.7	15:42	63.1
	Day 3	11/3/2016	72.0	13:37	72.1	9:50	7:25	46.9	8:40	57.7	6:32	50.0
Week 5	Day 1	11/8/2016	66.9	11:13	73.4	10:51	15:44	58.8	9:00	47.7	7:53	55.9
	Day 2	11/9/2016				12:03	16:30	64.0	14:54	68.2	12:04	66.9
	Day 3	11/10/2016	67.6			9:27	7:03	47.5	8:37	51.1	8:08	49.8
Week 6	Day 1	11/14/2016	72.9	13:29	70.5	11:09	6:55	49.1	8:47	48.4	7:54	52.9
	Day 2	11/15/2016		10:33	66.4	10:01	7:51	47.7	9:27	52.0	12:52	58.8
	Day 3	11/17/2016	66.4	13:34	74.1	12:24	11:06	69.1	12:42	69.4	16:09	63.7
Week 7	Day 1	11/21/2016	70.3	11:03	68.4	11:24	8:09	29.8	9:40	30.6	13:18	42.1
	Day 2	11/22/2016	71.1	10:35	69.3	10:50	7:49	31.8	9:19	40.5	12:44	41.7
	Day 3	11/23/2016	70.2	10:24	68.2	10:26	7:23	45.1	8:46	43.3	12:18	44.2
Week 8	Day 1	11/28/2016	70.2	10:20	68.2	9:01	7:44	44.4	9:19	45.9	8:18	44.8
	Day 2	11/30/2016	67.1	10:17	69.6	8:58	7:33	39.9	10:05	40.8	7:54	35.6
	Day 3	12/2/2016	69.4	10:41	69.3	10:49	7:42	35.4	9:16	37.2	12:45	37.0
Week 9	Day 1	12/5/2016	70.5	10:16	70.0	8:52	7:53	37.4	9:24	42.4	7:50	34.2
	Day 2	12/7/2016	71.1	10:55	66.6	9:11	7:21	20.7	10:00	21.6	8:20	22.8
	Day 3	12/9/2016	72.5	11:22	68.7	11:26	8:16	22.6	9:45	23.4	13:22	29.5
Week 10	Day 1	12/12/2016	71.8	10:38	66.6	9:15	8:09	9.7	9:41	11.8	8:25	20.7
	Day 2	12/14/2016	69.4		69.8	9:05	8:06	0.1	9:20	1.6	8:25	14.5
	Day 3	12/16/2016	69.3	11:34	72.0	10:46	8:05	19.0	9:30	18.0	13:38	21.7
Week 11	Day 1	12/19/2016	71.6	10:19	71.8	10:17	7:52	-1.7	9:20	-0.6	8:10	21.2
	Day 2	12/20/2016	68.0	8:58	70.0	10:42	12:54	30.6	14:40	34.7	7:59	28.8
	Day 3	12/21/2016	68.5	11:19	70.7	10:50	10:17	36.7	8:45	33.6	13:18	39.6
Week 12	Day 1	12/27/2016	69.4	8:54	69.4	11:11	11:25	28.2	12:54	27.5	8:03	23.7
	Day 2	12/28/2016	70.7	8:06	71.8	11:31	11:20	43.5	10:00	36.7	13:31	42.6
	Day 3	12/29/2016	69.4	13:01	69.6	11:14	10:58	37.2	9:32	31.6	8:00	30.0

Table B-8

TA (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chanvenet's Statistical Rejection									
Maximum			74.5		74.1			72.0		79.3		72.9
Minimum			66.4		66.4			-1.7		-0.6		14.5
Average			70.6		70.2			42.5		43.5		45.1
Median			70.5		69.9			45.0		43.3		44.5
Range			8.1		7.7			73.6		79.9		58.3
Std. Deviation			2.2		2.2			18.6		19.2		15.9

Table B-8

TA (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	8:21	58.3	8:47	64.8
	Day 2	**10/5/2016**	13:25	74.1	12:39	73.6
	Day 3	**10/6/2016**	15:01	68.9	9:02	66.2
Week 2	**Day 1**	**10/10/2016**	8:15	57.6	8:37	64.8
	Day 2	**10/12/2016**	16:37	63.5	13:08	65.5
	Day 3	**10/13/2016**	15:56	63.3	8:39	46.4
Week 3	**Day 1**	**10/18/2016**	18:26	68.2	8:54	71.2
	Day 2	**10/20/2016**	15:14	60.6	8:27	44.1
	Day 3	**10/21/2016**				
Week 4	**Day 1**	**11/1/2016**	14:50	58.6	15:09	72.7
	Day 2	**11/2/2016**	17:04	59.2	10:43	55.8
	Day 3	**11/3/2016**	12:27	59.9	14:09	66.4
Week 5	**Day 1**	**11/8/2016**	9:55	59.5	11:47	64.8
	Day 2	**11/9/2016**	7:35	47.8	9:13	55.0
	Day 3	**11/10/2016**	13:04	58.3	10:27	53.1
Week 6	**Day 1**	**11/14/2016**	18:05	63.3	14:06	53.4
	Day 2	**11/15/2016**	8:49	49.5	11:07	59.9
	Day 3	**11/17/2016**	7:57	61.2	14:09	71.8
Week 7	**Day 1**	**11/21/2016**	14:10	51.8	11:43	31.3
	Day 2	**11/22/2016**	13:10	42.4	11:10	43.3
	Day 3	**11/23/2016**	13:03	82.6	10:42	47.1
Week 8	**Day 1**	**11/28/2016**	9:00	45.0	10:44	48.0
	Day 2	**11/30/2016**	8:40	43.2	10:40	41.2
	Day 3	**12/2/2016**	13:18	37.0	11:07	36.0
Week 9	**Day 1**	**12/5/2016**	8:30	35.8	10:46	43.5
	Day 2	**12/7/2016**	8:58	24.3	11:17	22.6
	Day 3	**12/9/2016**	13:59	30.2	11:50	24.1
Week 10	**Day 1**	**12/12/2016**	9:00	26.2	11:03	10.2
	Day 2	**12/14/2016**	9:00	20.1	10:34	2.7
	Day 3	**12/16/2016**		20.3	11:52	22.5
Week 11	**Day 1**	**12/19/2016**	15:10	16.3	10:55	27.3
	Day 2	**12/20/2016**	8:41	23.7	9:18	34.5
	Day 3	**12/21/2016**	10:08	31.1	11:43	34.5
Week 12	**Day 1**	**12/27/2016**	14:09	27.3	9:25	24.6
	Day 2	**12/28/2016**	14:16	43.9	8:30	29.1
	Day 3	**12/29/2016**	14:13	33.6	13:30	32.5

Table B-8

TA (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
			Values after Chauvenet			
Maximum				82.6		73.6
Minimum				16.3		2.7
Average				47.6		45.8
Median				49.5		46.4
Range				66.3		70.9
Std. Deviation				17.2		18.6

Table B-9

RH

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:39	7:12	6:34	59.6	8:30	58.8	6:34	62.9	
	Day 2	**10/5/2016**	11:44	11:34	6:49	61.7	14:23	59.6	10:31	56.6	14:02
	Day 3	**10/6/2016**	8:59	8:32	6:29	61.7	8:01	60.4	6:50	64.7	12:55
Week 2	**Day 1**	**10/10/2016**	7:36	7:16	6:29	44.9	8:07	57.6	6:29	48.2	
	Day 2	**10/12/2016**	12:59	12:40	6:14	51.4	14:25	36.7	14:16	67.5	15:53
	Day 3	**10/13/2016**	9:45	9:58	6:38	40.6			6:40	40.3	16:37
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09	39.4	14:31	50.8	7:01	59.3	17:47
	Day 2	**10/20/2016**	10:34	10:32	6:11	51.8	8:07	48.5	13:14	44.4	14:39
	Day 3	**10/21/2016**	6:48	6:29					6:29	38.8	
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	52.3	8:36	60.4	7:22	40.0	14:37
	Day 2	**11/2/2016**	11:41	11:24	6:53	56.4	8:21	49.8	15:09	55.4	16:30
	Day 3	**11/3/2016**	9:40	9:31	6:46	50.2	8:07	47.3	6:06	48.1	13:00
Week 5	**Day 1**	**11/8/2016**	10:55	10:59	15:10	29.7			7:14	43.0	10:20
	Day 2	**11/9/2016**	12:59	13:55	15:52	32.4	14:19	29.2	11:36	28.1	
	Day 3	**11/10/2016**	9:01	8:34	6:26	36.5	8:03	39.8	7:31	30.5	12:17
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	32.1	8:07	32.1	7:15	52.0	16:45
	Day 2	**11/15/2016**	9:51	9:42			8:52	42.2			
	Day 3	**11/17/2016**	12:14	12:04	10:31	48.5	12:04	44.2	15:33	45.6	8:40
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	21.7	9:14	15.9	12:55	17.2	15:29
	Day 2	**11/22/2016**	10:50	10:50	7:15	22.8	8:45	18.1	12:10	25.7	15:29
	Day 3	**11/23/2016**	10:21	10:17	6:55	35.9	8:22	31.8	11:56	33.6	13:50
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	36.8	8:55	28.1	7:52	34.7	10:01
	Day 2	**11/30/2016**	8:55	8:52	7:09	32.6	8:48	25.5	7:27	27.5	10:40
	Day 3	**12/2/2016**	10:43	10:36	7:07	31.8	8:43	20.7	12:11	22.7	14:22
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	31.4	8:52	26.3	7:13	24.3	9:50
	Day 2	**12/7/2016**	9:11	9:12	7:49	23.5	9:24	12.7	7:45	20.8	10:09
	Day 3	**12/9/2016**	11:21	11:17	7:42	22.2	9:13	14.3	12:55	20.6	15:14
Week 10	**Day 1**	**12/12/2016**	9:13	9:10	7:32	23.6	9:05	11.0	7:55	18.8	10:44
	Day 2	**12/14/2016**	9:01	8:58			9:00	9.5	7:47	12.3	10:09
	Day 3	**12/16/2016**	11:02	11:19	7:37	18.9	9:00	13.1	13:12	16.8	15:15
Week 11	**Day 1**	**12/19/2016**	9:58	9:38	7:24	19.5	8:47	8.5	7:25	13.0	14:19
	Day 2	**12/20/2016**	10:36	10:30	12:22	22.2	14:03	18.0	7:28	18.1	9:43
	Day 3	**12/21/2016**	10:47	10:44	9:52	26.4	8:23	18.4	12:59	22.1	11:11
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	26.1	12:19	14.0	7:36	16.5	15:07
	Day 2	**12/28/2016**	11:26	11:21	10:54	27.9	9:28	19.2	13:01	19.1	15:20
	Day 3	**12/29/2016**	11:10	11:06	10:36	28.9	9:03	17.9	7:31	20.9	15:20

Table B-9

RH (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						61.7		60.4		67.5	
Minimum						18.9		8.5		12.3	
Average						36.4		31.5		34.6	
Median						32.4		28.1		30.5	
Range						42.8		51.9		55.2	
Std. Deviation						13.0		17.0		16.2	

Table B-9

RH (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**				8:07	7:08	89.0	9:09	85.8	7:11	92.1
	Day 2	**10/5/2016**	43.5	12:06	52.0	11:54	7:21	85.5	14:59	85.9	11:08	67.6
	Day 3	**10/6/2016**	47.3	8:29	62.0	9:26	7:01	87.6	8:39	83.2	7:30	83.3
Week 2	**Day 1**	**10/10/2016**		8:02	63.2	7:56	7:05	83.8	8:40	67.0	7:05	62.1
	Day 2	**10/12/2016**	28.9	12:35	57.4	13:18	6:49	77.1	15:05	37.1	14:51	74.5
	Day 3	**10/13/2016**	37.9			9:33	7:11	42.5	8:44	50.3	7:18	65.7
Week 3	**Day 1**	**10/18/2016**	45.0	8:20	58.4	13:21	16:46	39.7	15:07	36.0	7:35	80.3
	Day 2	**10/20/2016**	41.7			10:36	6:46	74.7	8:41	67.0	13:52	52.0
	Day 3	**10/21/2016**				7:07					7:07	61.5
Week 4	**Day 1**	**11/1/2016**	25.4	14:34	51.9	12:45	16:37	49.1	9:14	73.3	7:55	51.5
	Day 2	**11/2/2016**	51.6	10:09	50.5	11:59	7:31	70.6	8:57	63.5	15:42	60.5
	Day 3	**11/3/2016**	42.0	13:37	49.3	9:50	7:25	74.7	8:40	50.5	6:32	65.3
Week 5	**Day 1**	**11/8/2016**	55.4	11:13	43.4	10:51	15:44	32.1	9:00	57.5	7:53	75.3
	Day 2	**11/9/2016**				12:03	16:30	35.7	14:54	29.7	12:04	30.3
	Day 3	**11/10/2016**	33.1			9:27	7:03	66.1	8:37	54.2	8:08	48.1
Week 6	**Day 1**	**11/14/2016**	32.6	13:29	44.1	11:09	6:55	51.5	8:47	59.6	7:54	65.4
	Day 2	**11/15/2016**		10:33	51.0	10:01	7:51	54.4	9:27	68.4	12:52	53.2
	Day 3	**11/17/2016**	54.7	13:34	40.6	12:24	11:06	50.6	12:42	47.4	16:09	60.2
Week 7	**Day 1**	**11/21/2016**	21.2	11:03	26.3	11:24	8:09	54.5	9:40	58.3	13:18	41.4
	Day 2	**11/22/2016**	26.4	10:35	29.0	10:50	7:49	72.2	9:19	67.2	12:44	71.2
	Day 3	**11/23/2016**	39.7	10:24	38.8	10:26	7:23	86.7	8:46		12:18	92.9
Week 8	**Day 1**	**11/28/2016**	36.4	10:20	36.8	9:01	7:44	69.2	9:19	66.2	8:18	89.9
	Day 2	**11/30/2016**	39.2	10:17	32.5	8:58	7:33	83.6	10:05	77.1	7:54	80.7
	Day 3	**12/2/2016**	31.8	10:41	26.7	10:49	7:42	63.8	9:16	63.3	12:45	53.6
Week 9	**Day 1**	**12/5/2016**	28.6	10:16	32.9	8:52	7:53	90.8	9:24	74.7	7:50	90.7
	Day 2	**12/7/2016**	22.0	10:55	23.1	9:11	7:21	62.5	10:00	62.4	8:20	72.5
	Day 3	**12/9/2016**	14.6	11:22	20.9	11:26	8:16	70.5	9:45	61.0	13:22	37.6
Week 10	**Day 1**	**12/12/2016**	20.4	10:38	21.4	9:15	8:09	65.7	9:41	56.8	8:25	74.2
	Day 2	**12/14/2016**	16.1		13.4	9:05	8:06	57.7	9:20	54.7	8:25	57.9
	Day 3	**12/16/2016**	16.5	11:34	15.5	10:46	8:05	60.1	9:30	34.4	13:38	39.8
Week 11	**Day 1**	**12/19/2016**	12.0	10:19	14.9	10:17	7:52	63.3	9:20	67.4	8:10	61.9
	Day 2	**12/20/2016**	15.7	8:58	21.9	10:42	12:54	58.2	14:40	48.7	7:59	73.8
	Day 3	**12/21/2016**	22.8	11:19	22.3	10:50	10:17	64.7	8:45	70.1	13:18	53.7
Week 12	**Day 1**	**12/27/2016**	21.2	8:54	21.8	11:11	11:25	61.3	12:54	66.5	8:03	69.8
	Day 2	**12/28/2016**	19.3	8:06	20.0	11:31	11:20	46.9	10:00	63.5	13:31	44.1
	Day 3	**12/29/2016**	21.7	13:01	20.7	11:14	10:58	54.2	9:32	64.9	8:00	72.5

Table B-9

RH (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection									
Maximum			55.4		63.2			90.8		85.9		92.9
Minimum			12.0		13.4			32.1		29.7		30.3
Average			31.1		35.4			64.3		61.0		64.6
Median			28.9		32.7			63.8		63.4		65.4
Range			43.4		49.8			58.7		56.2		62.6
Std. Deviation			12.3		15.2			15.4		13.6		15.7

Table B-9

RH (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	8:21	89.9	8:47	88.0
	Day 2	**10/5/2016**	13:25	68.9	12:39	70.4
	Day 3	**10/6/2016**	15:01	45.7	9:02	87.9
Week 2	**Day 1**	**10/10/2016**	8:15	71.6	8:37	60.9
	Day 2	**10/12/2016**	16:37	33.4	13:08	76.9
	Day 3	**10/13/2016**	15:56	60.0	8:39	51.5
Week 3	**Day 1**	**10/18/2016**	18:26	44.8	8:54	76.7
	Day 2	**10/20/2016**	15:14	43.8	8:27	62.2
	Day 3	**10/21/2016**				
Week 4	**Day 1**	**11/1/2016**	14:50	36.4	15:09	47.6
	Day 2	**11/2/2016**	17:04	63.8	10:43	82.5
	Day 3	**11/3/2016**	12:27	54.4	14:09	53.6
Week 5	**Day 1**	**11/8/2016**	9:55	63.2	11:47	42.7
	Day 2	**11/9/2016**	7:35	55.5	9:13	75.2
	Day 3	**11/10/2016**	13:04	36.1	10:27	52.2
Week 6	**Day 1**	**11/14/2016**	18:05	44.4	14:06	64.7
	Day 2	**11/15/2016**	8:49	86.4	11:07	52.4
	Day 3	**11/17/2016**	7:57	59.6	14:09	43.5
Week 7	**Day 1**	**11/21/2016**	14:10	30.8	11:43	56.6
	Day 2	**11/22/2016**	13:10	71.3	11:10	61.6
	Day 3	**11/23/2016**	13:03	82.6	10:42	70.2
Week 8	**Day 1**	**11/28/2016**	9:00	90.1	10:44	63.4
	Day 2	**11/30/2016**	8:40	63.0	10:40	77.3
	Day 3	**12/2/2016**	13:18	59.4	11:07	54.1
Week 9	**Day 1**	**12/5/2016**	8:30	85.1	10:46	68.3
	Day 2	**12/7/2016**	8:58	67.8	11:17	62.5
	Day 3	**12/9/2016**	13:59	37.1	11:50	53.4
Week 10	**Day 1**	**12/12/2016**	9:00	61.2	11:03	51.9
	Day 2	**12/14/2016**	9:00	49.4	10:34	57.7
	Day 3	**12/16/2016**		51.4	11:52	35.8
Week 11	**Day 1**	**12/19/2016**	15:10	39.4	10:55	57.9
	Day 2	**12/20/2016**	8:41	54.2	9:18	60.6
	Day 3	**12/21/2016**	10:08	69.5	11:43	64.0
Week 12	**Day 1**	**12/27/2016**	14:09	60.1	9:25	71.7
	Day 2	**12/28/2016**	14:16	46.3	8:30	81.4
	Day 3	**12/29/2016**	14:13	65.9	13:30	66.2

Table B-9

RH (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
			Values after Chauvenet			
Maximum				90.1		88.0
Minimum				30.8		35.8
Average				58.4		63.0
Median				59.6		62.2
Range				59.3		52.2
Std. Deviation				16.2		12.6

Table B-10

DP

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:39	7:12	6:34	54.3	8:30	57.0	6:34	59.9	
	Day 2	**10/5/2016**	11:44	11:34	6:49	56.8	14:23	57.0	10:31	56.1	14:02
	Day 3	**10/6/2016**	8:59	8:32	6:29	57.7	8:01	56.8	6:50	59.5	12:55
Week 2	**Day 1**	**10/10/2016**	7:36	7:16	6:29	46.9	8:07	55.6	6:29	52.5	
	Day 2	**10/12/2016**	12:59	12:40	6:14	51.6	14:25	41.7	14:16	58.8	15:53
	Day 3	**10/13/2016**	9:45	9:58	6:38	41.7			6:40	43.3	16:37
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09	52.2	14:31	54.3	7:01	56.3	17:47
	Day 2	**10/20/2016**	10:34	10:32	6:11	50.2	8:07	48.6	13:14	45.5	14:39
	Day 3	**10/21/2016**	6:48	6:29					6:29	40.5	
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	55.8	8:36	55.2	7:22	44.8	14:37
	Day 2	**11/2/2016**	11:41	11:24	6:53	52.7	8:21	49.5	15:09	53.2	16:30
	Day 3	**11/3/2016**	9:40	9:31	6:46	47.8	8:07	47.5	6:06	46.2	13:00
Week 5	**Day 1**	**11/8/2016**	10:55	10:59	15:10	37.4			7:14	48.9	10:20
	Day 2	**11/9/2016**	12:59	13:55	15:52	40.3	14:19	39.6	11:36	36.1	
	Day 3	**11/10/2016**	9:01	8:34	6:26	39.4	8:03	43.2	7:31	35.8	12:17
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	37.2	8:07	38.5	7:15	48.0	16:45
	Day 2	**11/15/2016**	9:51	9:42			8:52	46.0			
	Day 3	**11/17/2016**	12:14	12:04	10:31	48.6	12:04	51.6	15:33	51.3	8:40
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	26.8	9:14	24.1	12:55	25.3	15:29
	Day 2	**11/22/2016**	10:50	10:50	7:15	28.6	8:45	28.8	12:10	34.0	15:29
	Day 3	**11/23/2016**	10:21	10:17	6:55	39.9	8:22	42.4	11:56	42.3	13:50
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	40.8	8:55	40.1	7:52	42.3	10:01
	Day 2	**11/30/2016**	8:55	8:52	7:09	37.6	8:48	37.6	7:27	37.2	10:40
	Day 3	**12/2/2016**	10:43	10:36	7:07	36.1	8:43	31.5	12:11	31.5	14:22
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	37.2	8:52	38.1	7:13	32.9	9:50
	Day 2	**12/7/2016**	9:11	9:12	7:49	28.2	9:24	19.8	7:45	27.9	10:09
	Day 3	**12/9/2016**	11:21	11:17	7:42	27.3	9:13	21.0	12:55	27.1	15:14
Week 10	**Day 1**	**12/12/2016**	9:13	9:10	7:32	28.6	9:05	17.1	7:55	26.8	10:44
	Day 2	**12/14/2016**	8:50	8:58			9:00	9.7	7:47	16.9	10:09
	Day 3	**12/16/2016**	11:02	11:19	7:37	23.2	9:00	17.8	13:12	23.2	15:15
Week 11	**Day 1**	**12/19/2016**	10:31	9:38	7:24	23.2	8:47	6.4	7:25	18.1	14:19
	Day 2	**12/20/2016**	10:36	10:30	12:22	29.5	14:03	25.5	7:28	26.4	9:43
	Day 3	**12/21/2016**	10:47	10:44	9:52	32.4	8:23	28.4	12:59	31.1	11:11
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	32.5	12:19	23.5	7:36	24.3	15:07
	Day 2	**12/28/2016**	11:26	11:21	10:54	34.2	9:28	28.0	13:01	28.0	15:20
	Day 3	**12/29/2016**	11:10	11:06	10:36	34.9	9:03	25.3	7:31	30.2	15:20

Table B-10

DP (Continued)

			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						57.7		57.0		59.9	
Minimum						23.2		6.4		16.9	
Average						39.7		36.6		38.9	
Median						37.6		38.5		37.2	
Range						34.6		50.6		43.0	
Std. Deviation						10.2		14.4		12.3	

Table B-10

DP (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**				8:07	7:08	50.5	9:09	62.1	7:11	60.6
	Day 2	**10/5/2016**	51.4	12:06	55.8	11:54	7:21	61.2	14:59	63.7	11:08	61.5
	Day 3	**10/6/2016**	52.0	8:29	56.1	9:26	7:01	62.1	8:39	61.7	7:30	61.2
Week 2	**Day 1**	**10/10/2016**		8:02	53.6	7:56	7:05	40.5	8:40	55.2	7:05	50.4
	Day 2	**10/12/2016**	37.6	12:35	54.7	13:18	6:49	52.2	15:05	39.9	14:51	49.6
	Day 3	**10/13/2016**	46.8			9:33	7:11	30.7	8:44	34.2	7:18	31.5
Week 3	**Day 1**	**10/18/2016**	51.6	8:20	56.5	13:21	16:46	44.4	15:07	48.0	7:35	64.2
	Day 2	**10/20/2016**	45.0			10:36	6:46	44.1	8:41	41.0	13:52	38.8
	Day 3	**10/21/2016**				7:07					7:07	32.5
Week 4	**Day 1**	**11/1/2016**	36.9	14:34	54.3	12:45	16:37	51.8	9:14	51.3	7:55	35.2
	Day 2	**11/2/2016**	52.0	10:09	54.3	11:59	7:31	47.7	8:57	44.4	15:42	49.5
	Day 3	**11/3/2016**	47.7	13:37	52.2	9:50	7:25	40.1	8:40	39.0	6:32	37.9
Week 5	**Day 1**	**11/8/2016**	50.5	11:13	49.8	10:51	15:44	29.8	9:00	33.8	7:53	48.4
	Day 2	**11/9/2016**				12:03	16:30	36.7	14:54	35.2	12:04	36.3
	Day 3	**11/10/2016**	38.1			9:27	7:03	36.7	8:37	34.7	8:08	31.8
Week 6	**Day 1**	**11/14/2016**	41.7	13:29	48.0	11:09	6:55	31.5	8:47	34.9	7:54	41.7
	Day 2	**11/15/2016**		10:33	47.8	10:01	7:51	34.9	9:27	42.1	12:52	41.9
	Day 3	**11/17/2016**	49.6	13:34	48.7	12:24	11:06	50.0	12:42	46.4	16:09	49.8
Week 7	**Day 1**	**11/21/2016**	28.9	11:03	32.4	11:24	8:09	13.8	9:40	17.8	13:18	20.1
	Day 2	**11/22/2016**	34.7	10:35	35.4	10:50	7:49	23.2	9:19	30.6	12:44	33.1
	Day 3	**11/23/2016**	45.0	10:24	42.3	10:26	7:23	41.2	8:46	43.0	12:18	42.4
Week 8	**Day 1**	**11/28/2016**	42.4	10:20	40.8	9:01	7:44	34.5	9:19	35.2	8:18	42.1
	Day 2	**11/30/2016**	40.8	10:17	38.8	8:58	7:33	37.2	10:05	34.3	7:54	30.4
	Day 3	**12/2/2016**	37.9	10:41	33.6	10:49	7:42	24.3	9:16	25.5	12:45	21.6
Week 9	**Day 1**	**12/5/2016**	36.3	10:16	39.4	8:52	7:53	35.1	9:24	35.1	7:50	31.8
	Day 2	**12/7/2016**	30.7	10:55	27.9	9:11	7:21	11.8	10:00	10.8	8:20	15.4
	Day 3	**12/9/2016**	21.7	11:22	27.1	11:26	8:16	13.5	9:45	11.7	13:22	6.6
Week 10	**Day 1**	**12/12/2016**	28.6	10:38	26.8	9:15	8:09	2.1	9:41	-1.7	8:25	13.6
	Day 2	**12/14/2016**	20.8		17.2	8:42					8:25	2.7
	Day 3	**12/16/2016**	21.7	11:34	23.9	10:46	8:05	6.6	9:30	-5.3	13:38	1.0
Week 11	**Day 1**	**12/19/2016**	17.2	10:19	21.0	11:25					8:10	10.2
	Day 2	**12/20/2016**	19.9	8:58	28.9	10:42	12:54	17.4	14:40	17.2	7:59	21.4
	Day 3	**12/21/2016**	29.3	11:19	30.6	10:50	10:17	25.7	8:45	25.0	13:18	23.9
Week 12	**Day 1**	**12/27/2016**	27.9	8:54	29.1	11:11	11:25	17.1	12:54	18.0	8:03	15.4
	Day 2	**12/28/2016**	26.6	8:06	29.5	11:31	11:20	24.6	10:00	25.7	13:31	22.3
	Day 3	**12/29/2016**	28.9	13:01	27.9	11:14	10:58	22.3	9:32	21.2	8:00	22.5

Table B-10

DP (Continued)

			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection									
Maximum			52.0		56.5			62.1		63.7		64.2
Minimum			17.2		17.2			2.1		-5.3		1.0
Average			36.8		39.5			33.2		33.7		33.3
Median			37.6		39.1			34.9		34.9		32.8
Range			34.7		39.2			59.9		68.9		63.2
Std. Deviation			10.7		12.1			15.0		16.5		16.7

Table B-10

DP (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	8:21	55.0	8:47	61.3
	Day 2	**10/5/2016**	13:25	63.9	12:39	62.8
	Day 3	**10/6/2016**	15:01	47.5	9:02	62.8
Week 2	**Day 1**	**10/10/2016**	8:15	48.2	8:37	51.1
	Day 2	**10/12/2016**	16:37	32.9	13:08	57.9
	Day 3	**10/13/2016**	15:56	49.5	8:39	29.8
Week 3	**Day 1**	**10/18/2016**	18:26	45.1	8:54	63.7
	Day 2	**10/20/2016**	15:14	38.5	8:27	31.8
	Day 3	**10/21/2016**				
Week 4	**Day 1**	**11/1/2016**	14:50	34.2	15:09	51.4
	Day 2	**11/2/2016**	17:04	46.2	10:43	52.0
	Day 3	**11/3/2016**	12:27	43.9	14:09	48.7
Week 5	**Day 1**	**11/8/2016**	9:55	45.9	11:47	41.4
	Day 2	**11/9/2016**	7:35	31.6	9:13	47.5
	Day 3	**11/10/2016**	13:04	31.5	10:27	30.6
Week 6	**Day 1**	**11/14/2016**	18:05	41.2	14:06	40.8
	Day 2	**11/15/2016**	8:49	45.3	11:07	41.9
	Day 3	**11/17/2016**	7:57	46.8	14:09	48.6
Week 7	**Day 1**	**11/21/2016**	14:10	18.9	11:43	17.6
	Day 2	**11/22/2016**	13:10	33.4	11:10	30.7
	Day 3	**11/23/2016**	13:03	41.7	10:42	40.1
Week 8	**Day 1**	**11/28/2016**	9:00	42.1	10:44	36.1
	Day 2	**11/30/2016**	8:40	29.8	10:40	34.5
	Day 3	**12/2/2016**	13:18	23.7	11:07	20.8
Week 9	**Day 1**	**12/5/2016**	8:30	31.8	10:46	34.2
	Day 2	**12/7/2016**	8:58	15.3	11:17	11.8
	Day 3	**12/9/2016**	13:59	7.5	11:50	10.0
Week 10	**Day 1**	**12/12/2016**	9:00	13.6	11:03	-4.5
	Day 2	**12/14/2016**	9:00	4.3		
	Day 3	**12/16/2016**		6.1	11:52	-0.9
Week 11	**Day 1**	**12/19/2016**	15:10	-5.6	10:55	14.4
	Day 2	**12/20/2016**	8:41	9.7	9:18	22.1
	Day 3	**12/21/2016**	10:08	22.5	11:43	23.5
Week 12	**Day 1**	**12/27/2016**	14:09	15.3	9:25	17.1
	Day 2	**12/28/2016**	14:16	24.4	8:30	24.1
	Day 3	**12/29/2016**	14:13	23.5	13:30	22.6

Table B-10

DP (Continued)

			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
			Values after Chauvenet's			
Maximum				63.9		63.7
Minimum				-5.6		-4.5
Average				31.6		34.7
Median				32.9		34.3
Range				69.5		68.2
Std. Deviation				16.1		18.0

Table B-11

WB

Temp in °F			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
Week 1	**Day 1**	**10/3/2016**	7:39	7:12	6:34	59.7	8:30	62.6	6:34	64.6	
	Day 2	**10/5/2016**	11:44	11:34	6:49	61.9	14:23	62.4	10:31	62.2	14:02
	Day 3	**10/6/2016**	9:02	8:32	6:29	62.6	8:01	62.2	6:50	63.9	12:55
Week 2	**Day 1**	**10/10/2016**	7:36	7:16	6:29	56.5	8:07	61.5	6:29	60.3	
	Day 2	**10/12/2016**	12:59	12:40	6:14	59.2	14:25	54.0	14:16	62.8	15:53
	Day 3	**10/13/2016**	9:45	9:58	6:38	53.1			6:40	54.7	16:37
Week 3	**Day 1**	**10/18/2016**	13:03	12:45	16:09	63.1	14:31	61.7	7:01	61.9	17:47
	Day 2	**10/20/2016**	10:34	10:32	6:11	57.6	8:07	57.0	13:14	55.8	14:39
	Day 3	**10/21/2016**	6:48	6:29					6:29	52.9	
Week 4	**Day 1**	**11/1/2016**	12:29	12:14	16:02	62.4	8:36	60.6	7:22	55.6	14:37
	Day 2	**11/2/2016**	11:41	11:24	6:53	59.2	8:21	57.9	15:09	59.9	16:30
	Day 3	**11/3/2016**	9:40	9:31	6:46	55.9	8:07	56.7	6:06	54.9	13:00
Week 5	**Day 1**	**11/8/2016**	10:04	9:17			8:23	49.8	7:14	58.6	10:20
	Day 2	**11/9/2016**	12:59	13:55	15:52	54.3	14:19	55.8	11:36	52.9	
	Day 3	**11/10/2016**	9:01	8:34	6:26	52.5	8:03	53.8	7:31	52.0	12:17
Week 6	**Day 1**	**11/14/2016**	10:45	10:22	6:16	52.2	8:07	52.9	7:15	56.1	16:45
	Day 2	**11/15/2016**	9:51	9:42			8:52	56.5			
	Day 3	**11/17/2016**	12:14	12:04	10:31	57.0	12:04	60.6	15:33	60.1	8:40
Week 7	**Day 1**	**11/21/2016**	11:19	11:14	7:29	48.6	9:14	50.4	12:55	50.4	15:29
	Day 2	**11/22/2016**	10:50	10:50	7:15	49.5	8:45	52.3	12:10	52.2	15:29
	Day 3	**11/23/2016**	10:21	10:17	6:55	52.9	8:22	56.7	11:56	55.6	13:50
Week 8	**Day 1**	**11/28/2016**	8:57	8:53	7:21	53.6	8:55	56.1	7:52	55.2	10:01
	Day 2	**11/30/2016**	8:55	8:52	7:09	52.2	8:48	55.2	7:27	53.8	10:40
	Day 3	**12/2/2016**	10:43	10:36	7:07	51.6	8:43	53.1	12:11	51.4	14:22
Week 9	**Day 1**	**12/5/2016**	8:47	8:42	7:20	52.3	8:52	55.2	7:13	52.0	9:50
	Day 2	**12/7/2016**	9:22	9:12	7:49	49.1	9:24	50.2	7:45	50.0	10:09
	Day 3	**12/9/2016**	11:21	11:17	7:42	48.7	9:13	50.0	12:55	49.8	15:14
Week 10	**Day 1**	**12/12/2016**	9:05	9:10	7:32	49.1	9:05	49.3	7:55	50.5	10:44
	Day 2	**12/14/2016**	8:37	8:37	7:33	45.9	9:00	46.6	7:47	48.4	10:09
	Day 3	**12/16/2016**	11:19	11:19	7:37	47.5	9:00	48.0	13:12	48.9	15:15
Week 11	**Day 1**	**12/19/2016**	10:16	9:38	7:24	47.1	8:47	45.9	7:25	48.6	14:19
	Day 2	**12/20/2016**	10:36	10:30	12:22	50.7	14:03	50.2	7:28	50.7	9:43
	Day 3	**12/21/2016**	10:47	10:44	9:52	50.5	8:23	51.4	12:59	51.6	11:11
Week 12	**Day 1**	**12/27/2016**	11:05	10:59	11:02	50.7	12:19	50.7	7:36	50.2	15:07
	Day 2	**12/28/2016**	11:26	11:21	10:54	51.3	9:28	51.1	13:01	51.1	15:20
	Day 3	**12/29/2016**	11:10	11:06	10:36	51.3	9:03	50.5	7:31	51.6	15:20

Table B-11

WB (Continued)

Temp in °F			Avg. Total	Avg.	Indoor						
		Date	Time	Indoor T	Time	Location					
		Average	hh:mm	hh:mm	hh:mm	A	Time	B	Time	C	Time
			Values after Chauvenet's Statistical Rejection								
Maximum						63.1		62.6		64.6	
Minimum						45.9		45.9		48.4	
Average						53.6		54.4		54.6	
Median						52.3		53.9		52.9	
Range						17.3		16.7		16.2	
Std. Deviation						4.8		4.7		4.7	

Table B-11

WB (Continued)

Temp in °F			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
Week 1	**Day 1**	**10/3/2016**				8:07	7:08	52.3	9:09	63.5	7:11	61.5
	Day 2	**10/5/2016**	60.4	12:06	62.4	11:54	7:21	62.8	14:59	64.9	11:08	65.5
	Day 3	**10/6/2016**	60.3	8:29	61.2	9:32	7:01	63.9	8:39	63.7	7:30	63.0
Week 2	**Day 1**	**10/10/2016**		8:02	58.8	7:56	7:05	43.2	8:40	59.4	7:05	55.6
	Day 2	**10/12/2016**	53.8	12:35	60.6	13:18	6:49	55.2	15:05	50.2	14:51	52.9
	Day 3	**10/13/2016**	58.1			9:33	7:11	44.2	8:44	43.9	7:18	36.6
Week 3	**Day 1**	**10/18/2016**	60.6	8:20	62.2	13:21	16:46	55.6	15:07	61.5	7:35	66.4
	Day 2	**10/20/2016**	55.2			10:36	6:46	47.5	8:41	45.3	13:52	47.7
	Day 3	**10/21/2016**				7:07					7:07	39.4
Week 4	**Day 1**	**11/1/2016**	54.7	14:34	61.3	12:45	16:37	59.7	9:14	54.1	7:55	43.9
	Day 2	**11/2/2016**	59.2	10:09	61.7	11:59	7:31	50.0	8:57	50.7	15:42	54.9
	Day 3	**11/3/2016**	57.7	13:37	59.9	9:50	7:25	42.8	8:40	47.7	6:32	44.2
Week 5	**Day 1**	**11/8/2016**	57.2	11:13	59.4	10:51	15:44	45.3	9:00	41.4	7:53	51.6
	Day 2	**11/9/2016**				12:03	16:30	50.2	14:54	51.4	12:04	52.0
	Day 3	**11/10/2016**	52.2			9:27	7:03	42.3	8:37	43.3	8:08	42.1
Week 6	**Day 1**	**11/14/2016**	55.8	13:29	57.4	11:09	6:55	40.1	8:47	42.3	7:54	46.8
	Day 2	**11/15/2016**		10:33	55.6	10:01	7:51	42.1	9:27	46.6	12:52	50.0
	Day 3	**11/17/2016**	56.5	13:34	59.2	12:24	11:06	57.7	12:42	57.0	16:09	55.4
Week 7	**Day 1**	**11/21/2016**	50.5	11:03	50.5	11:24	8:09	23.4	9:40	26.2	13:18	33.8
	Day 2	**11/22/2016**	52.5	10:35	52.0	10:50	7:49	28.9	9:19	36.3	12:44	38.1
	Day 3	**11/23/2016**	55.9	10:24	54.0	10:26	7:23	43.2	8:46	43.0	12:18	43.3
Week 8	**Day 1**	**11/28/2016**	55.0	10:20	53.2	9:01	7:44	39.9	9:19	40.8	8:18	43.3
	Day 2	**11/30/2016**	53.1	10:17	53.4	8:58	7:33	39.7	10:05	38.1	7:54	33.4
	Day 3	**12/2/2016**	52.9	10:41	51.3	10:49	7:42	31.3	9:16	32.5	12:45	31.5
Week 9	**Day 1**	**12/5/2016**	52.9	10:16	53.6	8:52	7:53	36.3	9:24	39.0	7:50	33.3
	Day 2	**12/7/2016**	51.3	10:55	48.0	9:31					8:20	20.8
	Day 3	**12/9/2016**	49.6	11:22	49.3	11:26	8:16	20.5	9:45	19.9	13:22	23.4
Week 10	**Day 1**	**12/12/2016**	51.1	10:38	48.0	9:00						
	Day 2	**12/14/2016**	48.4		47.7							
	Day 3	**12/16/2016**	48.4	11:34	49.8							
Week 11	**Day 1**	**12/19/2016**	48.4	10:19	49.3	10:55						
	Day 2	**12/20/2016**	47.5	8:58	50.0	10:42	12:54	26.4	14:40	28.8	7:59	26.2
	Day 3	**12/21/2016**	49.8	11:19	51.1	10:50	10:17	32.4	8:45	30.6	13:18	33.4
Week 12	**Day 1**	**12/27/2016**	50.0	8:54	50.2	11:11	11:25	24.4	12:54	24.4	8:03	21.2
	Day 2	**12/28/2016**	50.2	8:06	51.1	11:31	11:20	35.8	10:00	32.5	13:31	34.9
	Day 3	**12/29/2016**	50.0	13:01	49.8	11:14	10:58	31.8	9:32	28.0	8:00	27.3

Table B-11

WB (Continued)

Temp in °F			Indoor			Avg.	Outdoor					
		Date	Location			Indoor T	Time	Location				
		Average	D	Time	E	hh:mm	hh:mm	A	Time	B	Time	C
			Values after Chauvenet's Statistical Rejection									
Maximum			60.6		62.4			63.9		64.9		66.4
Minimum			47.5		47.7			20.5		19.9		20.8
Average			53.5		54.4			42.3		43.6		42.9
Median			52.9		53.3			42.5		43.2		43.3
Range			13.1		14.8			43.4		45.0		45.5
Std. Deviation			3.8		4.9			11.6		12.3		12.6

Table B-11

WB (Continued)

Temp in °F			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
Week 1	**Day 1**	**10/3/2016**	8:21	56.3	8:47	62.4
	Day 2	**10/5/2016**	13:25	67.1	12:39	66.4
	Day 3	**10/6/2016**	15:01	56.5		
Week 2	**Day 1**	**10/10/2016**	8:15	52.3	8:37	56.5
	Day 2	**10/12/2016**	16:37	47.8	13:08	60.6
	Day 3	**10/13/2016**	15:56	55.4	8:39	39.0
Week 3	**Day 1**	**10/18/2016**	18:26	55.6	8:54	66.2
	Day 2	**10/20/2016**	15:14	49.8	8:27	38.8
	Day 3	**10/21/2016**				
Week 4	**Day 1**	**11/1/2016**	14:50	47.5	15:09	59.7
	Day 2	**11/2/2016**	17:04	52.2	10:43	53.4
	Day 3	**11/3/2016**	12:27	51.1	14:09	56.1
Week 5	**Day 1**	**11/8/2016**	9:55	52.5	11:47	52.2
	Day 2	**11/9/2016**	7:35	41.0	9:13	50.7
	Day 3	**11/10/2016**	13:04	45.9	10:27	43.2
Week 6	**Day 1**	**11/14/2016**	18:05	51.6	14:06	47.3
	Day 2	**11/15/2016**	8:49	47.1	11:07	50.4
	Day 3	**11/17/2016**	7:57	53.2	14:09	58.1
Week 7	**Day 1**	**11/21/2016**	14:10	37.6	11:43	26.8
	Day 2	**11/22/2016**	13:10	38.5	11:10	37.9
	Day 3	**11/23/2016**	13:03	44.4	10:42	43.0
Week 8	**Day 1**	**11/28/2016**	9:00	43.5	10:44	42.4
	Day 2	**11/30/2016**	8:40	37.4	10:40	38.3
	Day 3	**12/2/2016**	13:18	32.2	11:07	30.6
Week 9	**Day 1**	**12/5/2016**	8:30	34.2	10:46	39.4
	Day 2	**12/7/2016**	8:58	21.6	11:17	19.4
	Day 3	**12/9/2016**	13:59	24.1	11:50	19.9
Week 10	**Day 1**	**12/12/2016**	9:00	22.8		
	Day 2	**12/14/2016**				
	Day 3	**12/16/2016**				
Week 11	**Day 1**	**12/19/2016**			10:55	23.4
	Day 2	**12/20/2016**	8:41	20.1	9:18	30.0
	Day 3	**12/21/2016**	10:08	27.9	11:43	30.4
Week 12	**Day 1**	**12/27/2016**	14:09	24.1	9:25	22.5
	Day 2	**12/28/2016**	14:16	36.1	8:30	27.3
	Day 3	**12/29/2016**	14:13	29.8	13:30	28.9

Table B-11

WB (Continued)

Temp in °F			Outdoor			
		Date	Location			
		Average	Time	D	Time	E
			Values after Chauvenet			
Maximum				67.1		66.4
Minimum				20.1		19.4
Average				42.4		42.6
Median				45.1		42.4
Range				47.0		47.0
Std. Deviation				12.1		14.1

Appendix C – Graphs by Location

Graphs present all indoor or outdoor contaminant levels per location. For ease of high level comparisons between locations, all graphs have forced axes. The left-hand axes denote contaminant levels of $PM_{2.5}$, PM_{10}, and CO, while the right-hand axes denote NO_2, SO_2, and O_3. The contaminants were put on the respective axis according to the magnitude of possible contamination levels. Indoor contamination graphs were forced to a left-hand axis of 12.0 and a right-hand axis of 0.180. Outdoor contamination graphs were forced to a left-hand axis of 35.0 and a right-hand axis of 0.140.

Figure C-1. Location A, indoor contaminants.

Figure C-2. Location B, indoor contaminants.

Figure C-3. Location C, indoor contaminants.

Figure C-4. Location D, indoor contaminants.

Figure C-5. Location E, indoor contaminants.

Figure C-6. Location A, outdoor contaminants.

Figure C-7. Location B, outdoor contaminants.

Figure C-8. Location C, outdoor contaminants.

Figure C-9. Location D, outdoor contaminants.

Figure C-10. Location E, outdoor contaminants.

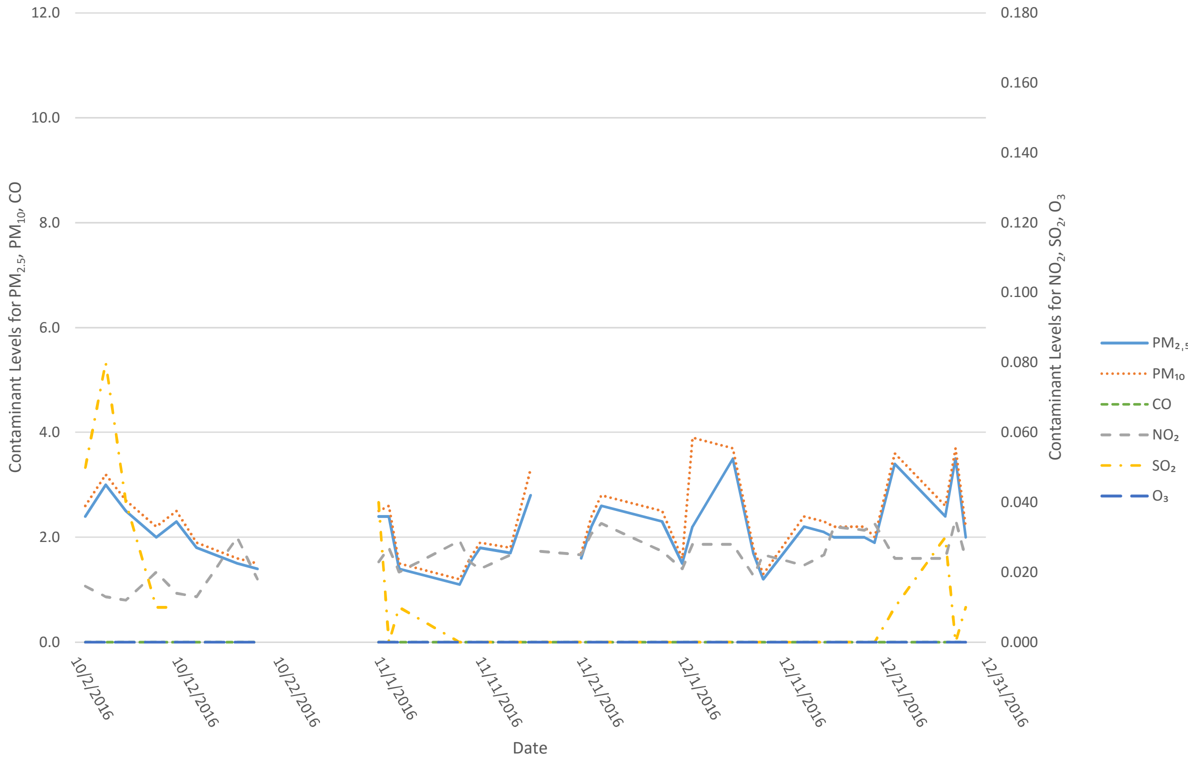

Figure C-1. Location A, indoor contaminants.

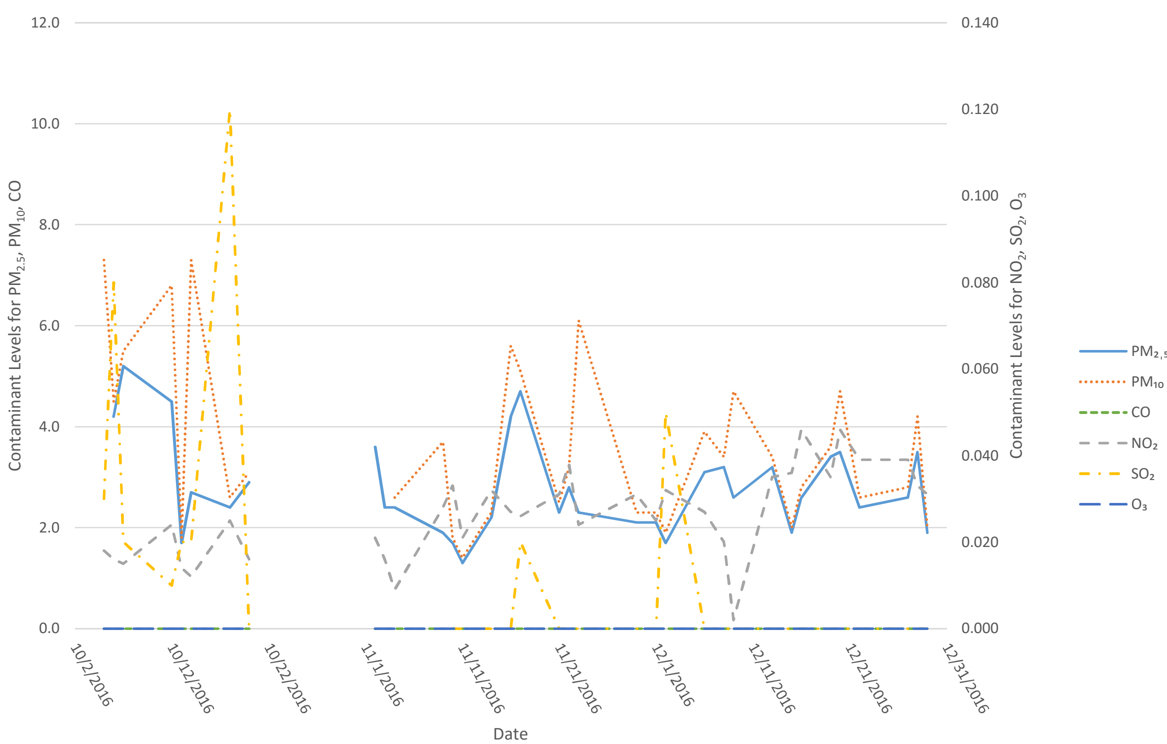

Figure C-2. Location B, indoor contaminants.

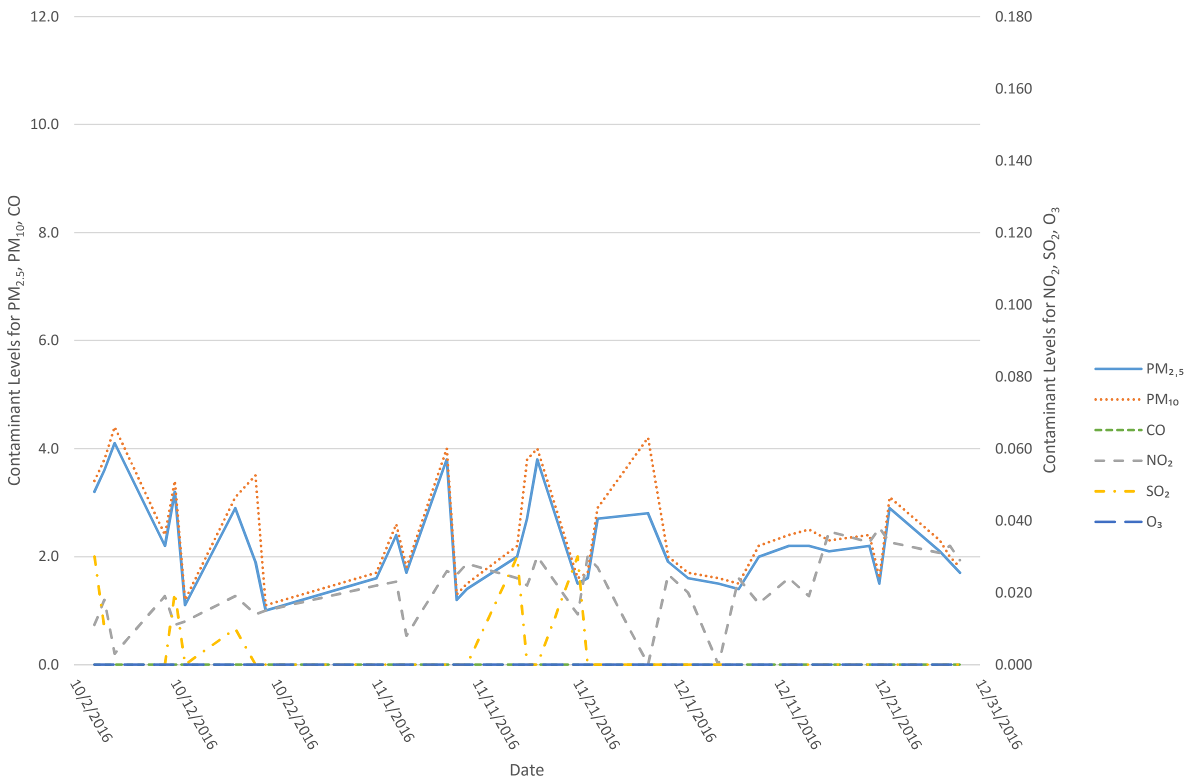

Figure C-3. Location C, indoor contaminants.

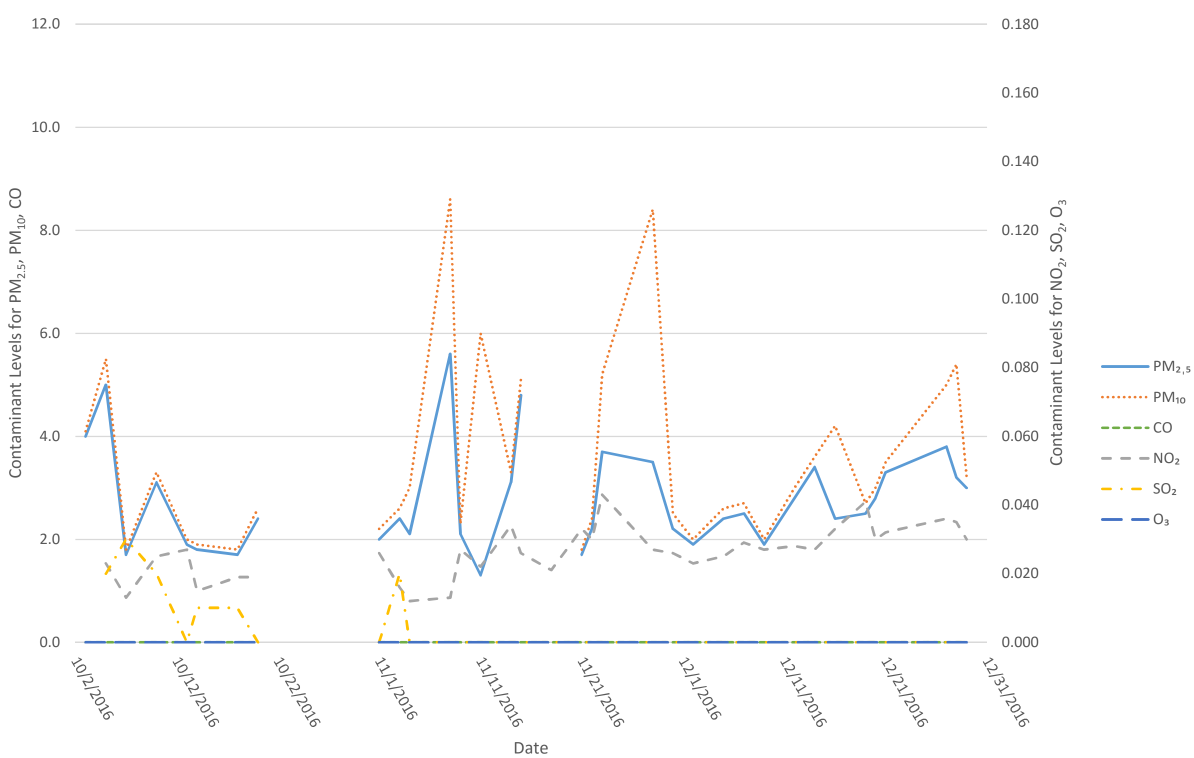

Figure C-4. Location D, indoor contaminants.

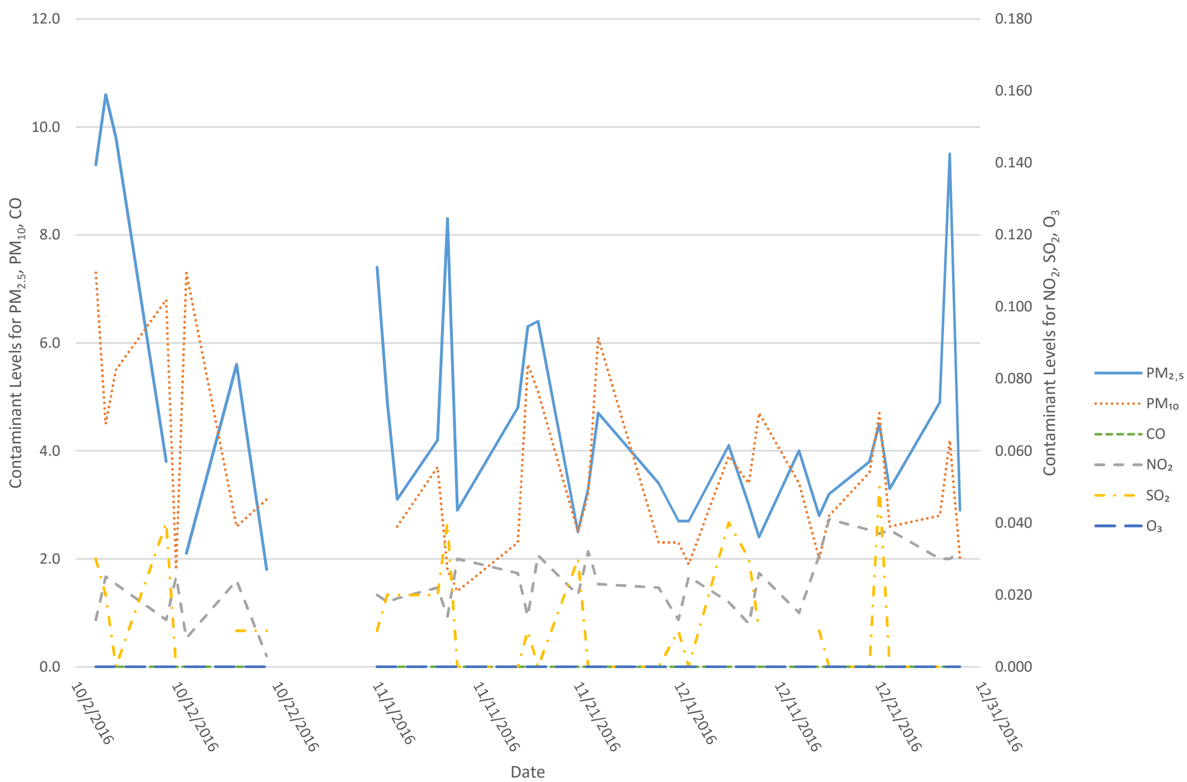

Figure C-5. Location E, indoor contaminants.

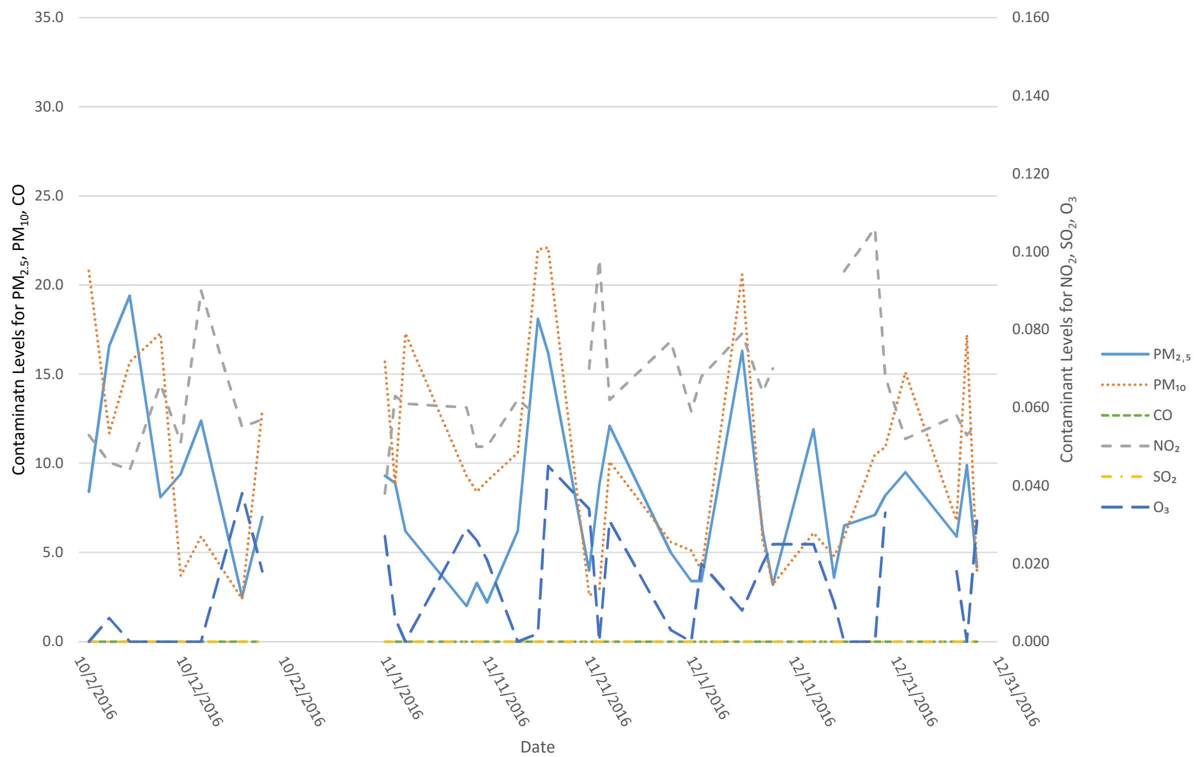

Figure C-6. Location A, outdoor contaminants.

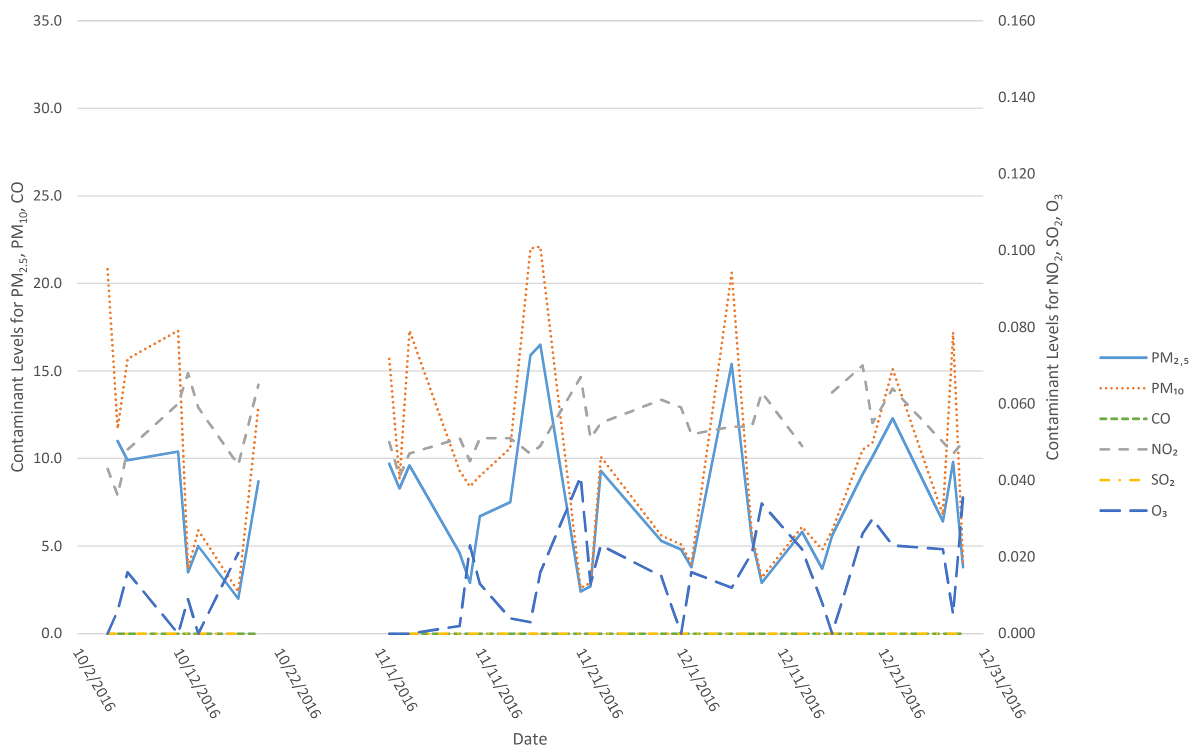

Figure C-7. Location B, outdoor contaminants.

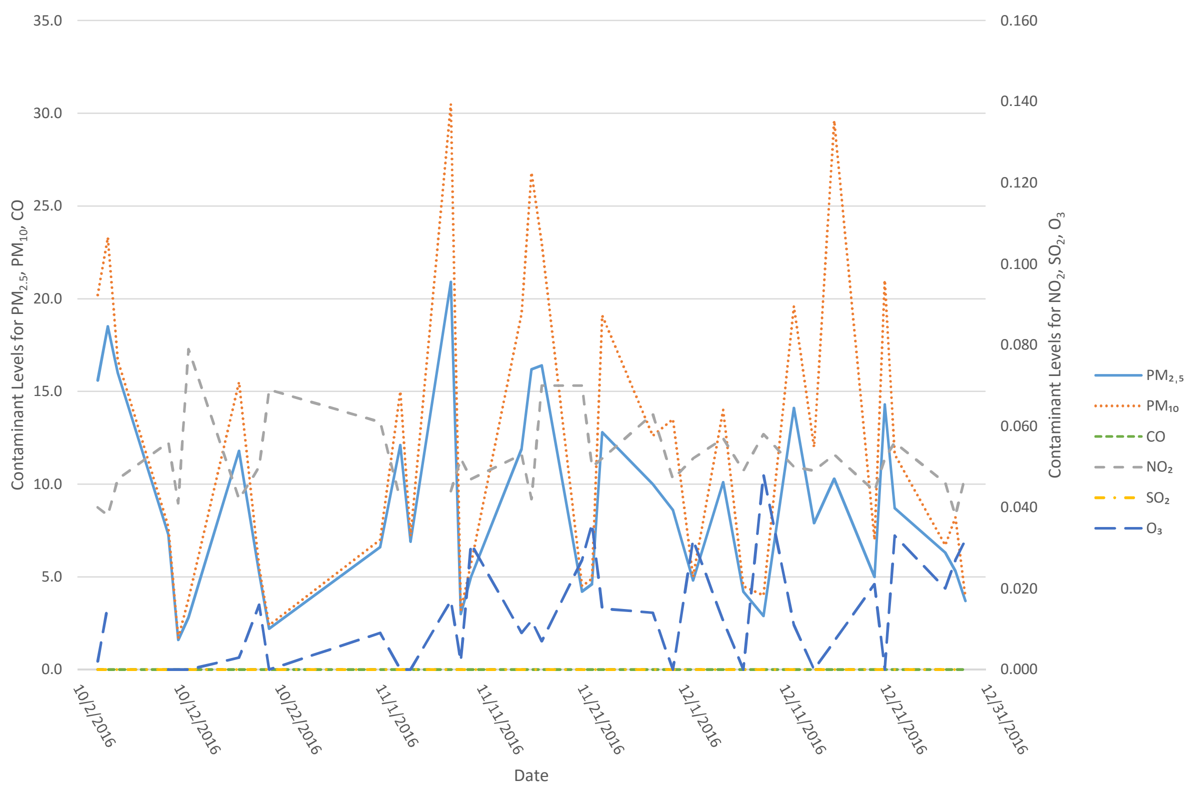

Figure C-8. Location C, outdoor contaminants.

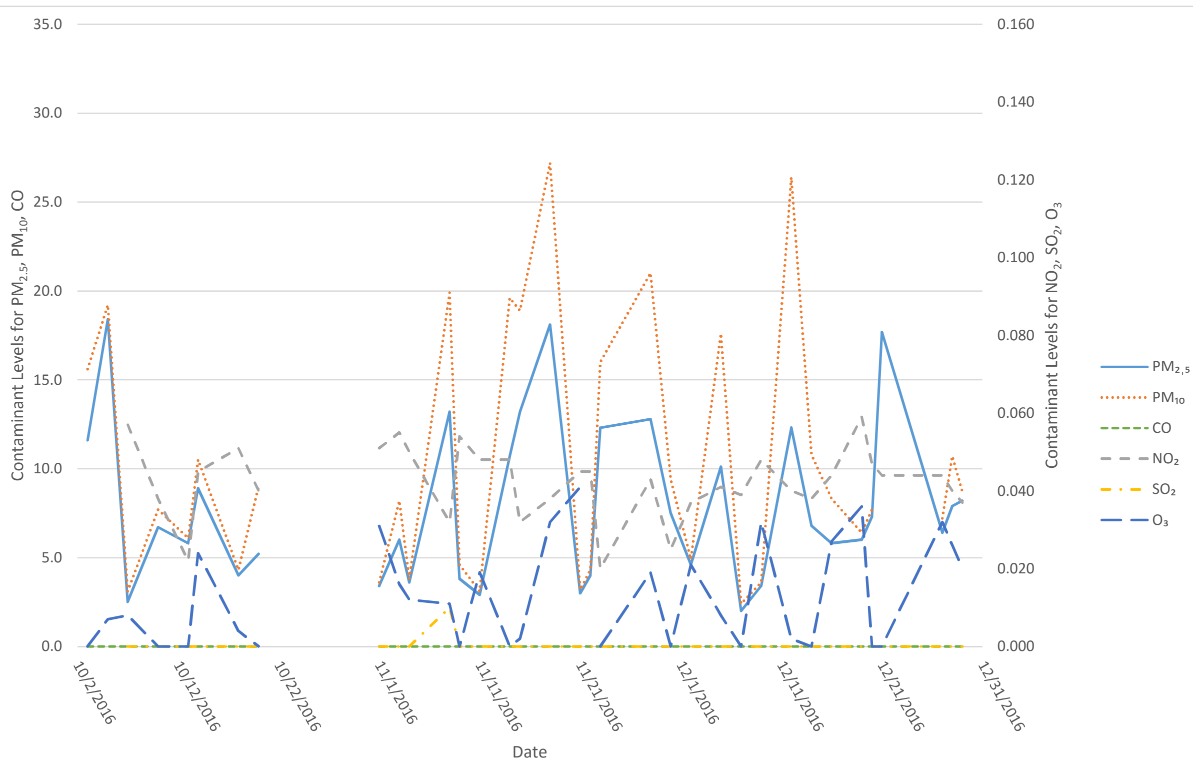

Figure C-9. Location D, outdoor contaminants.

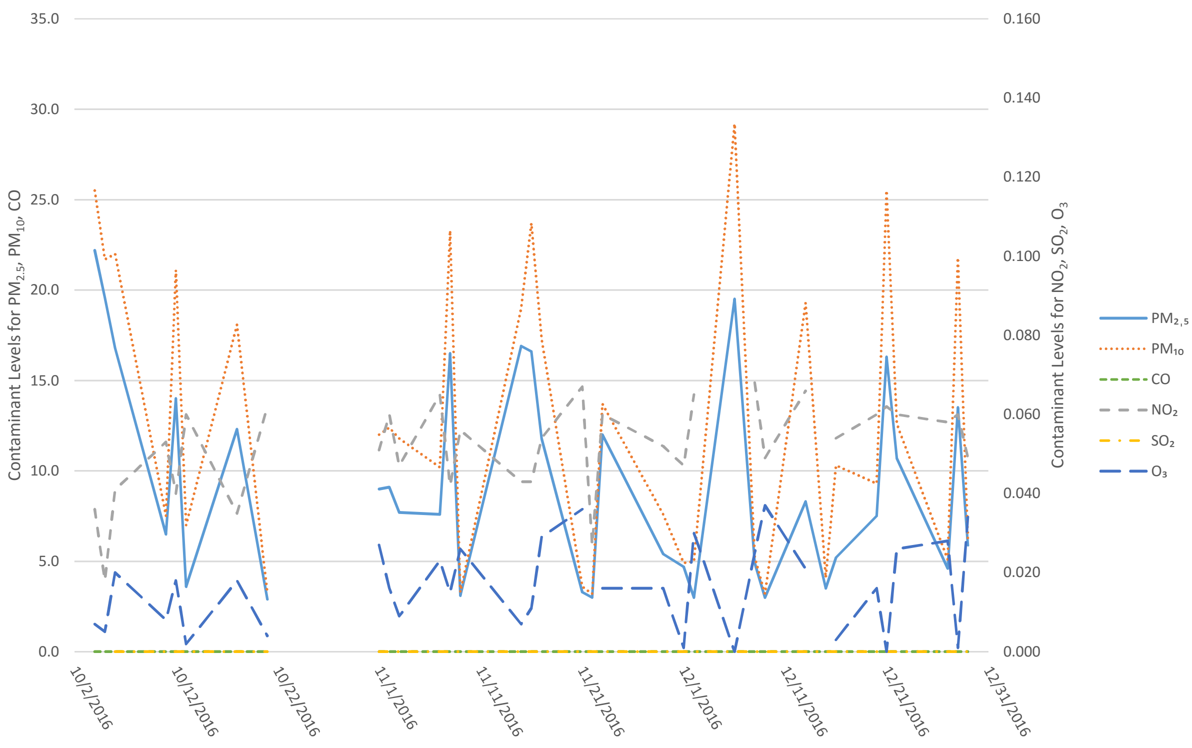

Figure C-10. Location E, outdoor contaminants.

Appendix D – Graphs by Contaminant Levels

Graphs present indoor or outdoor contaminant levels per contaminant type. Indoor and outdoor contamination levels were forced to the same value. $PM_{2.5}$ and PM_{10} were forced to 35 μg/m^3. NO_2 was forced to 0.120 ppm. SO_2 was forced to 0.180 ppm. O_3 was forced to 0.070 ppm.

Figure D-1. $PM_{2.5}$, indoor contaminant levels.

Figure D-2. PM_{10}, indoor contaminant levels.

Figure D-3. NO_2, indoor contaminant levels.

Figure D-4. SO_2, indoor contaminant levels.

Figure D-5. O_3, indoor contaminant levels.

Figure D-6. CO, indoor contaminant levels.

Figure D-7. $PM_{2.5}$, outdoor contaminant levels.

Figure D-8. PM_{10}, outdoor contaminant levels.

Figure D-9. NO_2, outdoor contaminant levels.

Figure D-10. SO_2, outdoor contaminant levels.

Figure D-11. O_3, outdoor contaminant levels.

Figure D-12. CO, outdoor contaminant levels.

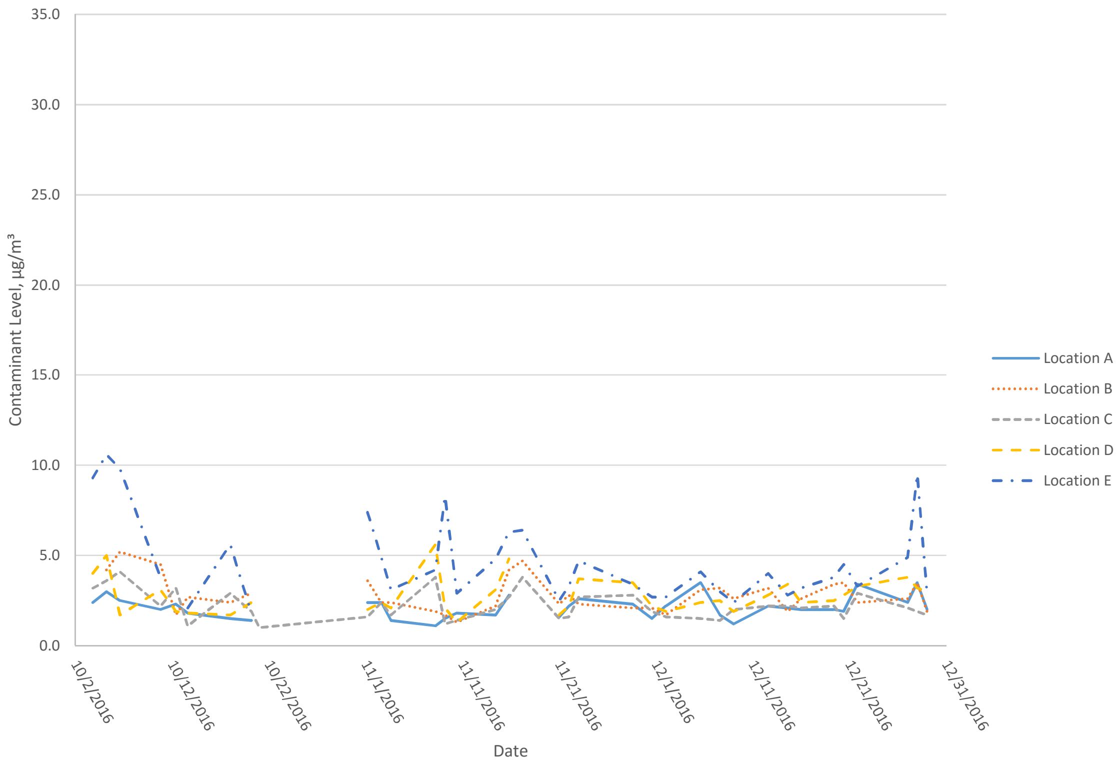

Figure D-1. $PM_{2.5}$, indoor.

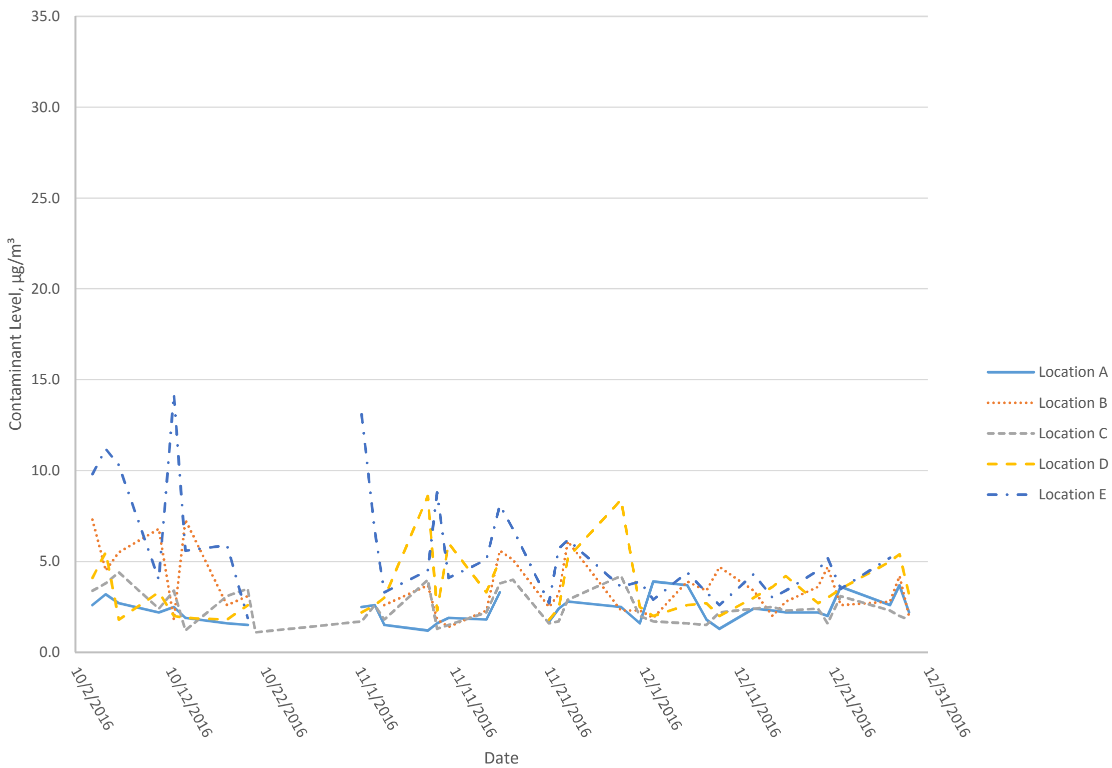

Figure D-2. PM_{10}, indoor.

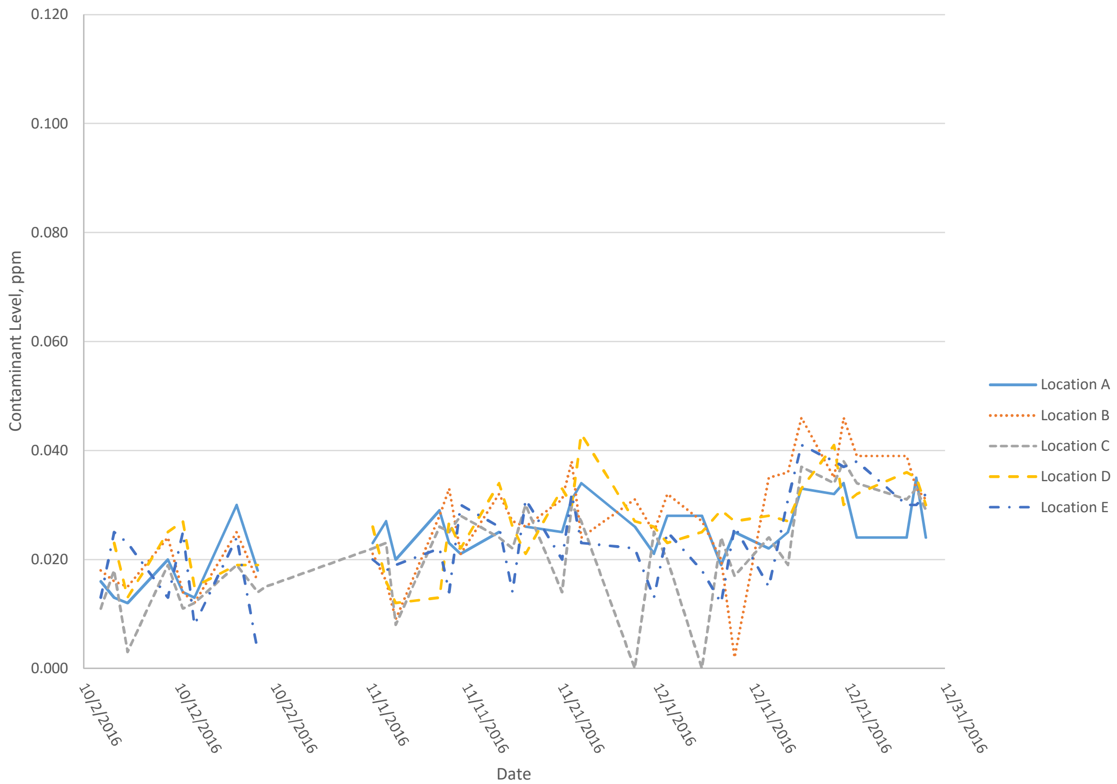

Figure D-3. NO_2, indoor.

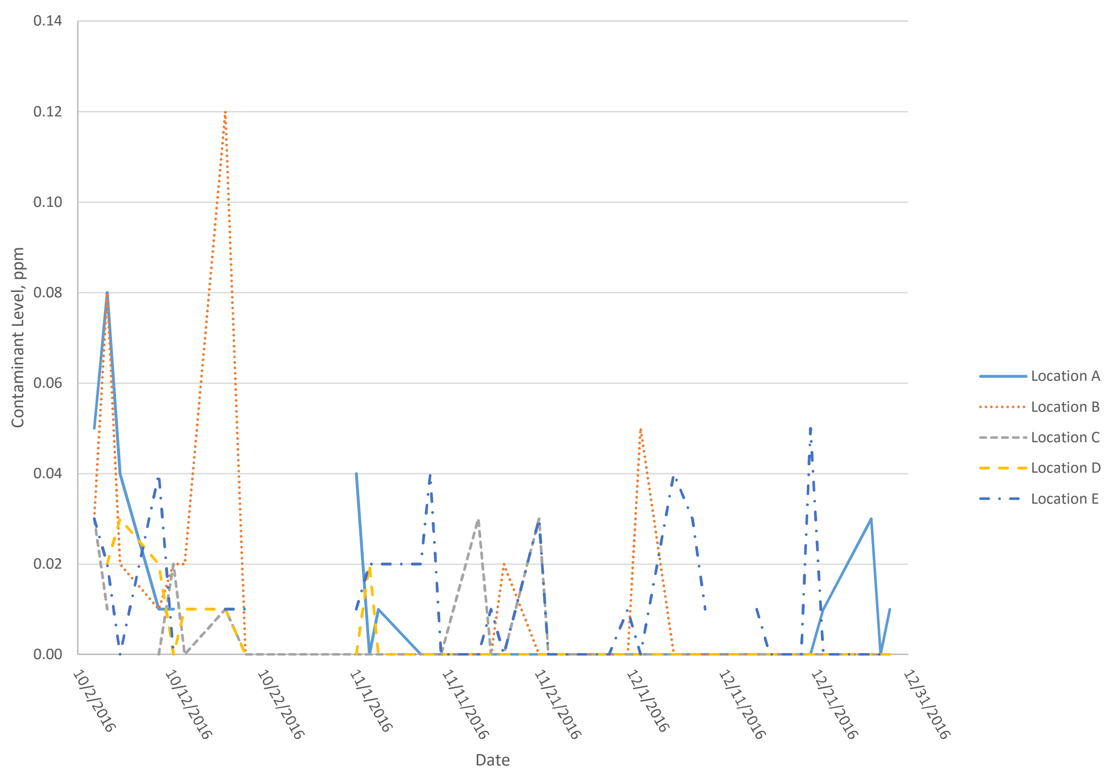

Figure D-4. SO_2, indoor.

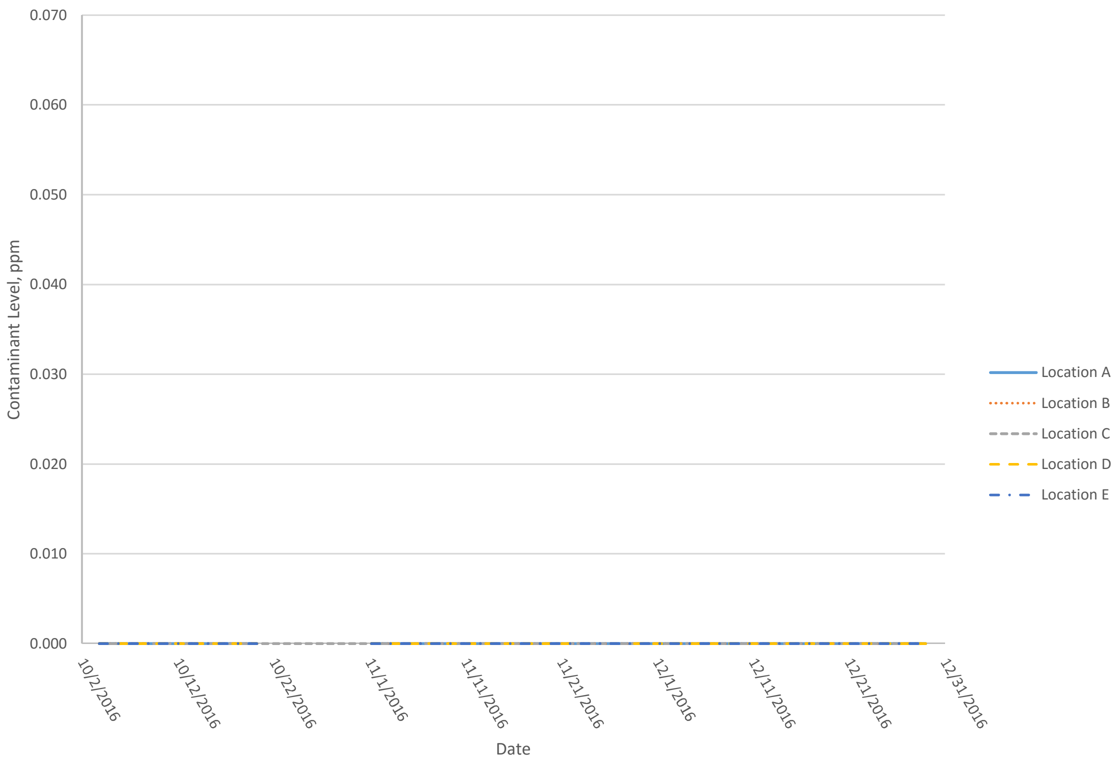

Figure D-5. O_3, indoor.

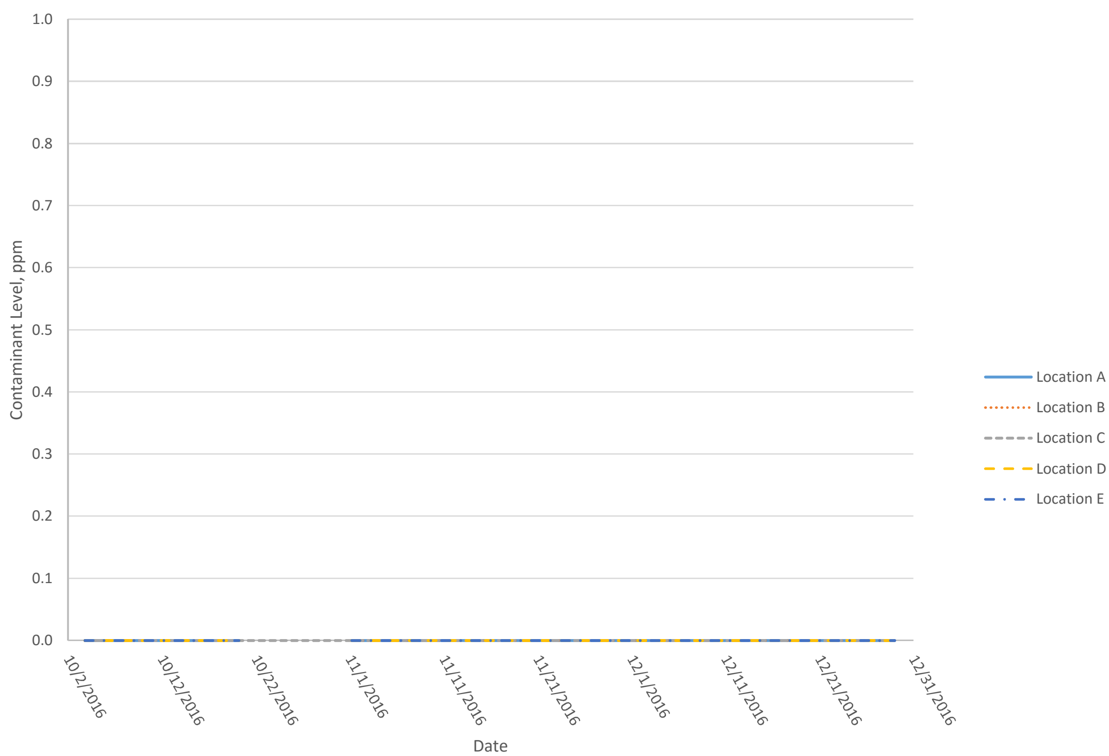

Figure D-6. CO, indoor.

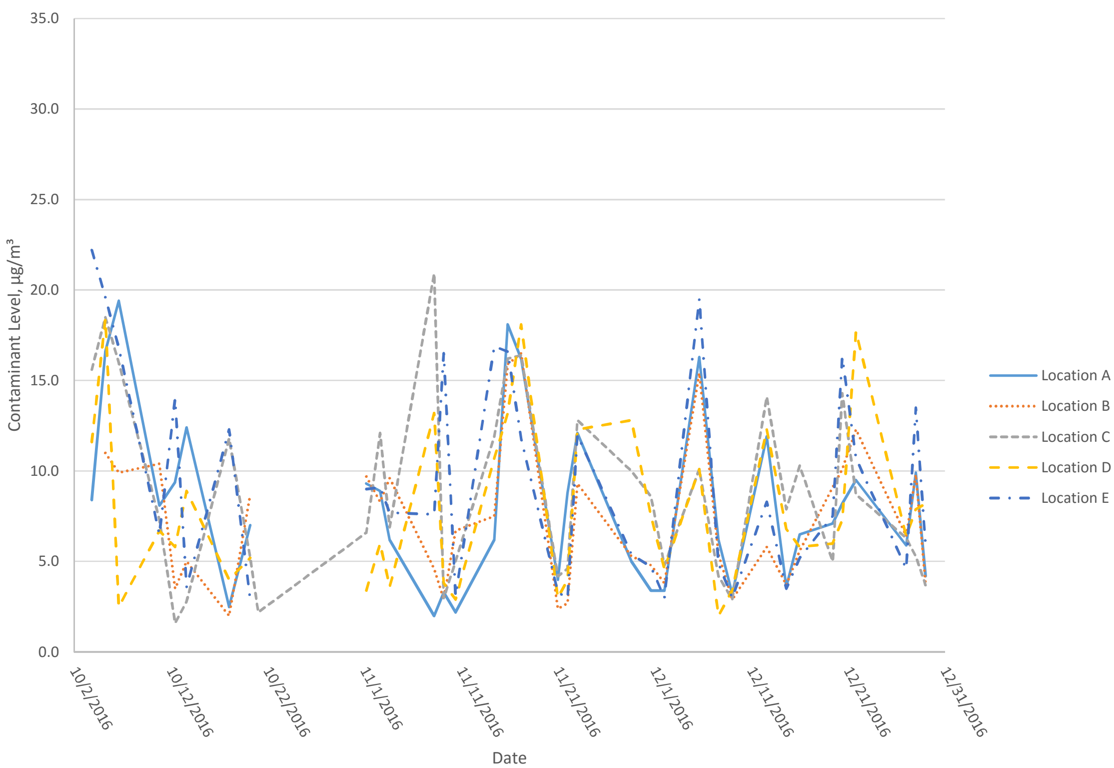

Figure D-7. $PM_{2.5}$, outdoor.

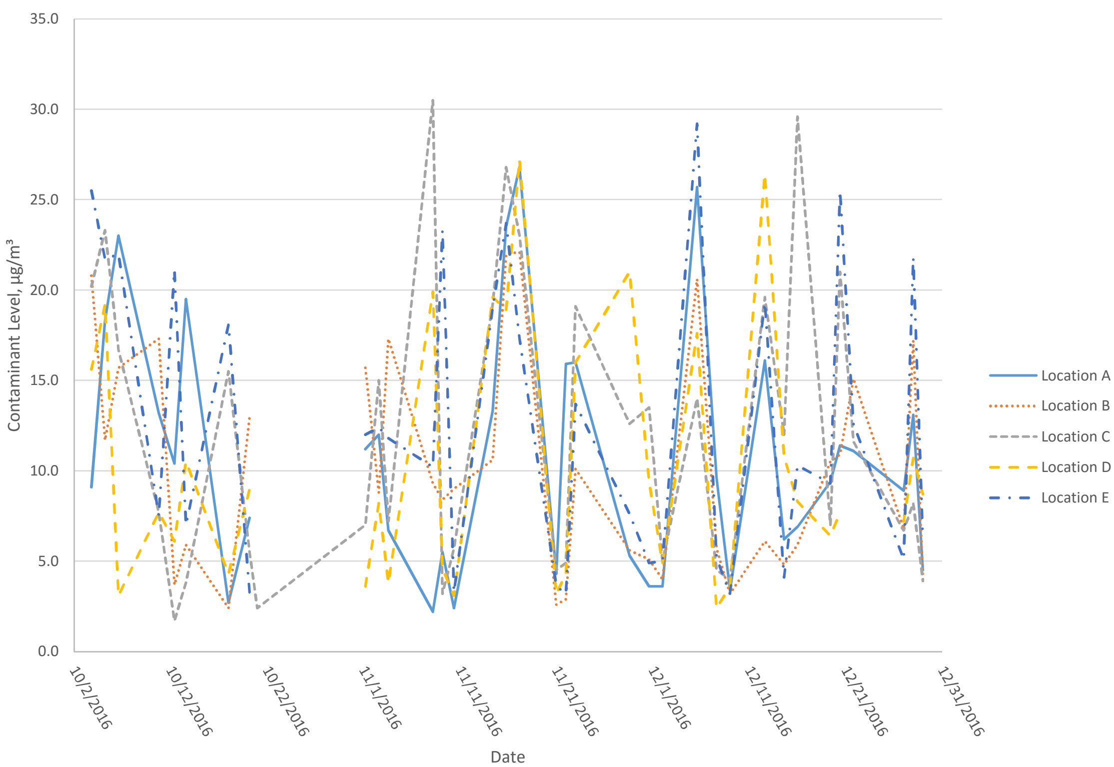

Figure D-8. PM_{10}, outdoor.

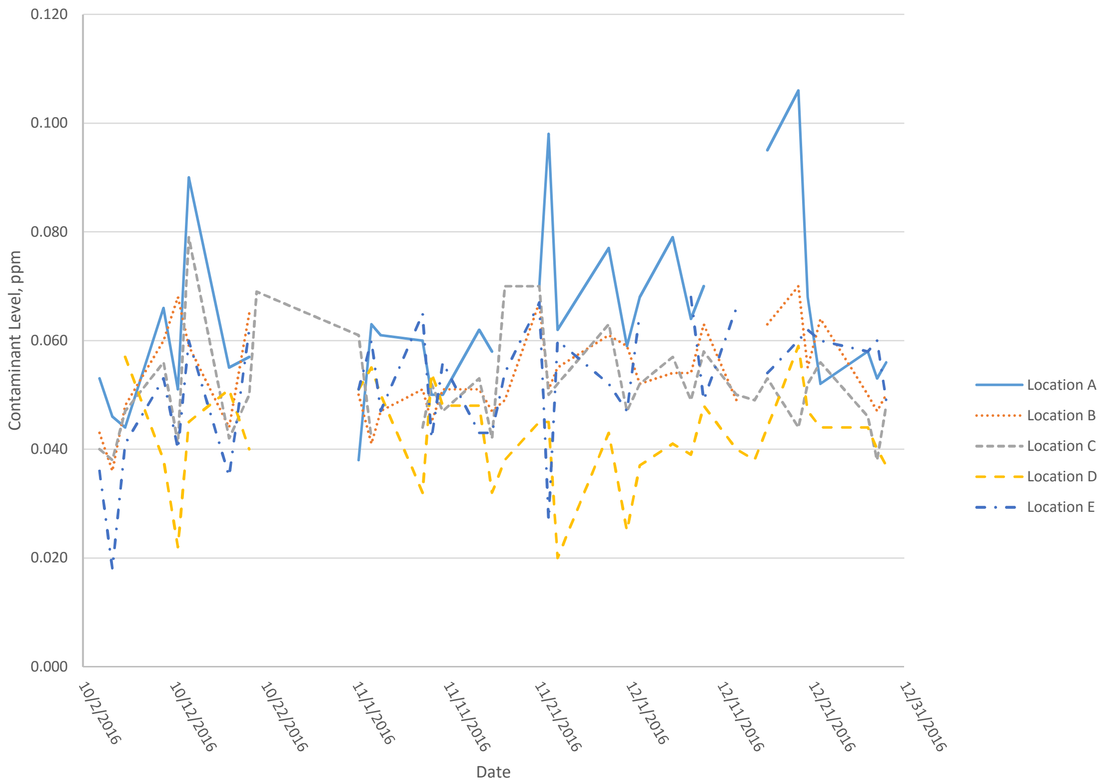

Figure D-9. NO_2, outdoor.

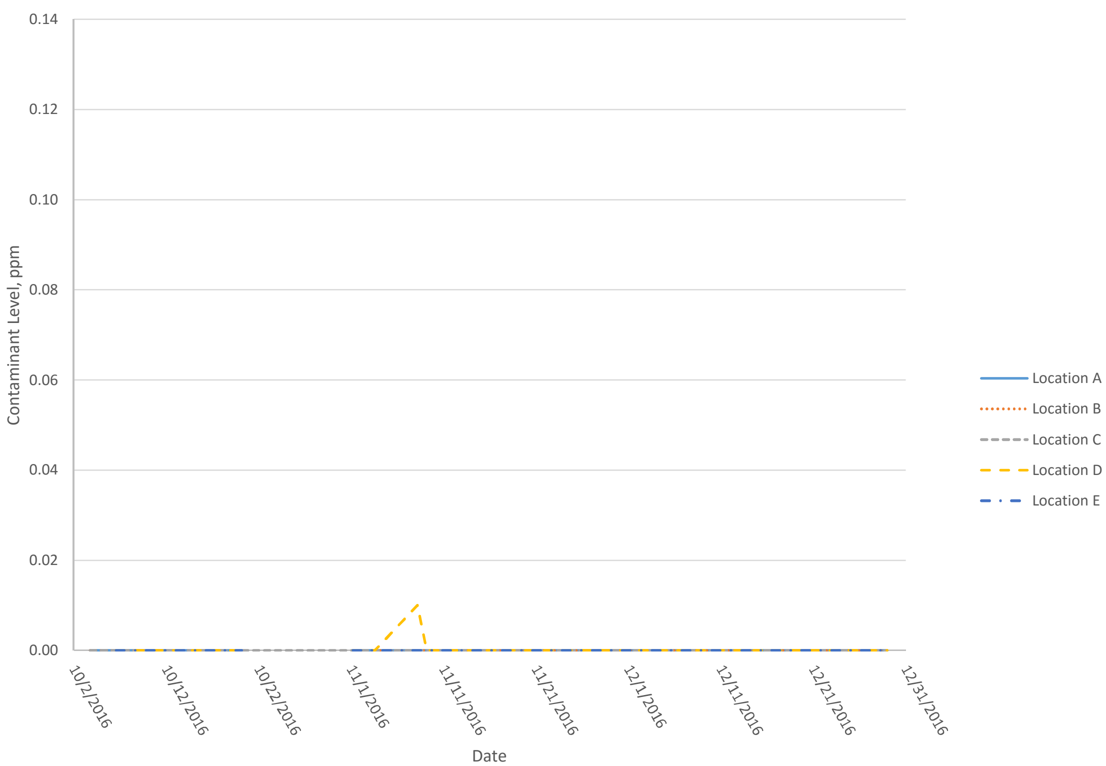

Figure D-10. SO_2, outdoor.

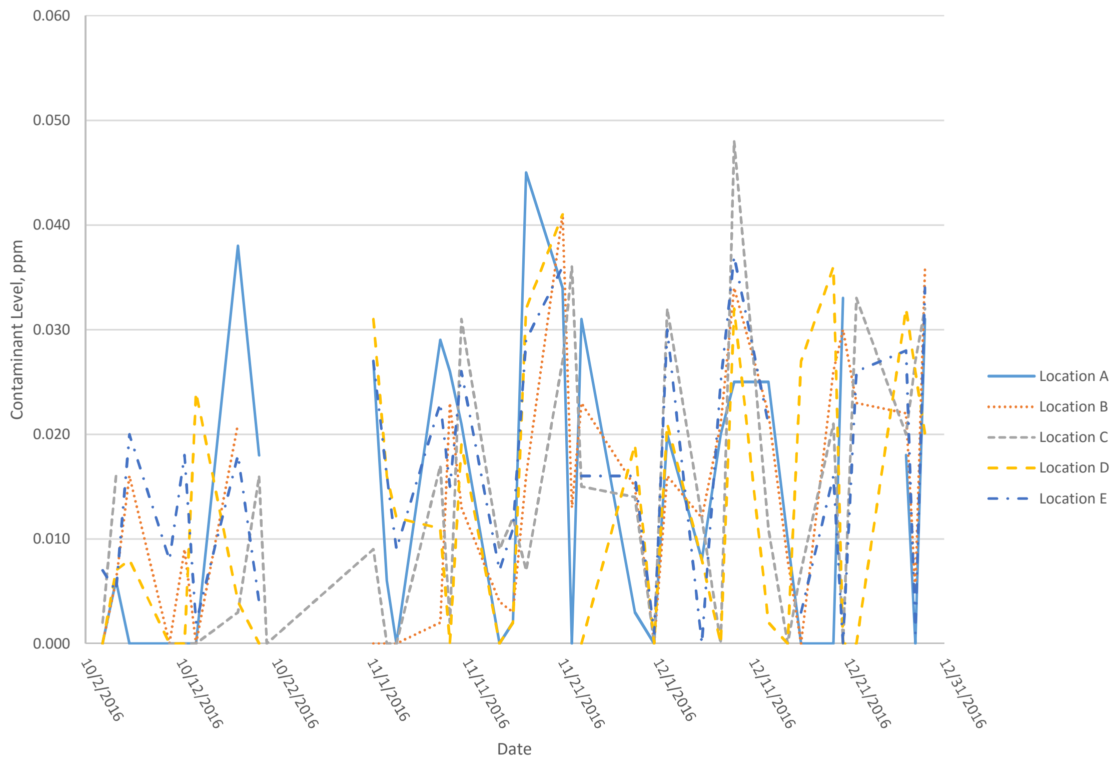

Figure D-11. O_3, outdoor.

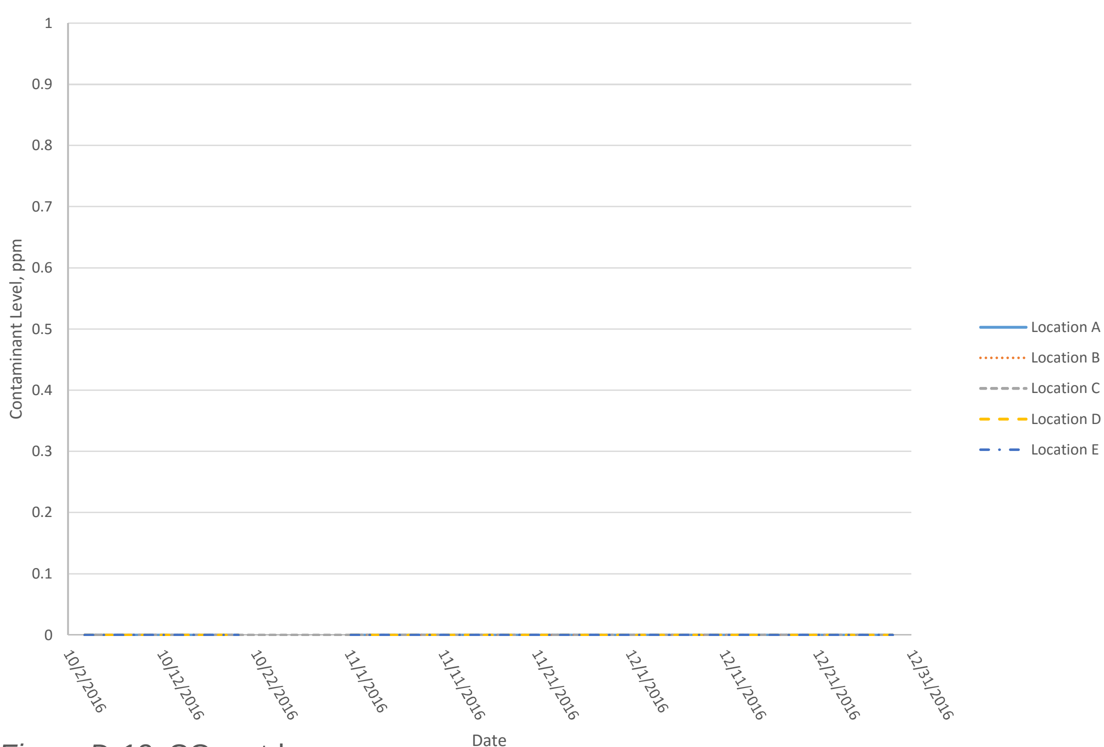

Figure D-12. CO, outdoor.

Appendix E – Graphs by Contaminant, Indoor vs. Outdoor Contaminant Levels

Graphs present indoor contaminant levels against the outdoor level measured at the same time. Graphs are per contaminant type. Axes were not forced to any value. CO was not included because all CO values were measured at 0 ppm.

Figure E-1. $PM_{2.5}$, indoor vs outdoor levels.

Figure E-2. PM_{10}, indoor vs outdoor levels.

Figure E-3. NO_2, indoor vs outdoor levels.

Figure E-4. SO_2, indoor vs outdoor levels.

Figure E-5. O_3, indoor vs outdoor levels.

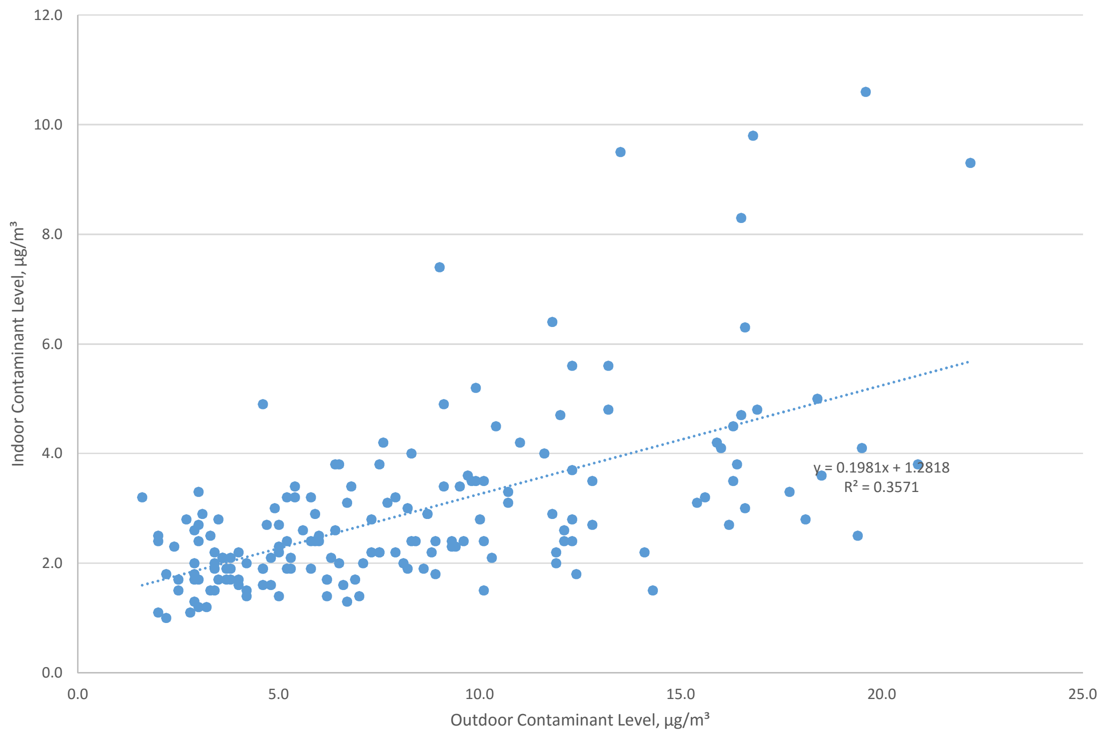

Figure E-1. $PM_{2.5}$, indoor vs outdoor contaminant levels.

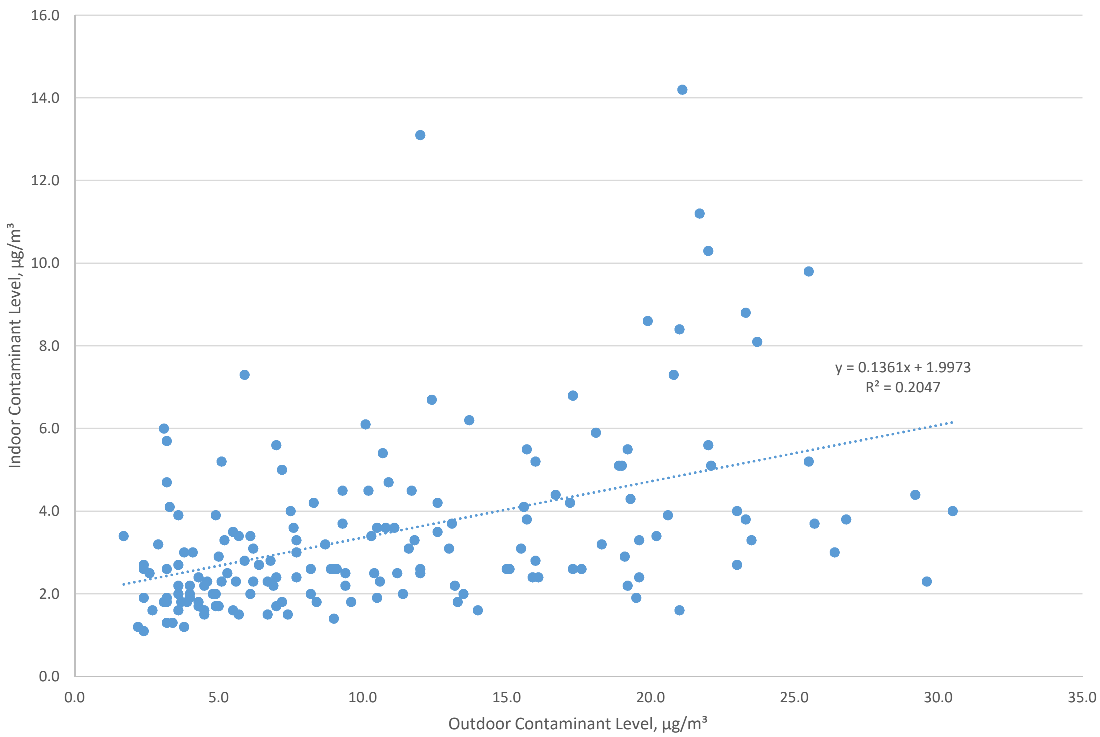

Figure E-2. PM_{10}, indoor vs outdoor contaminant levels.

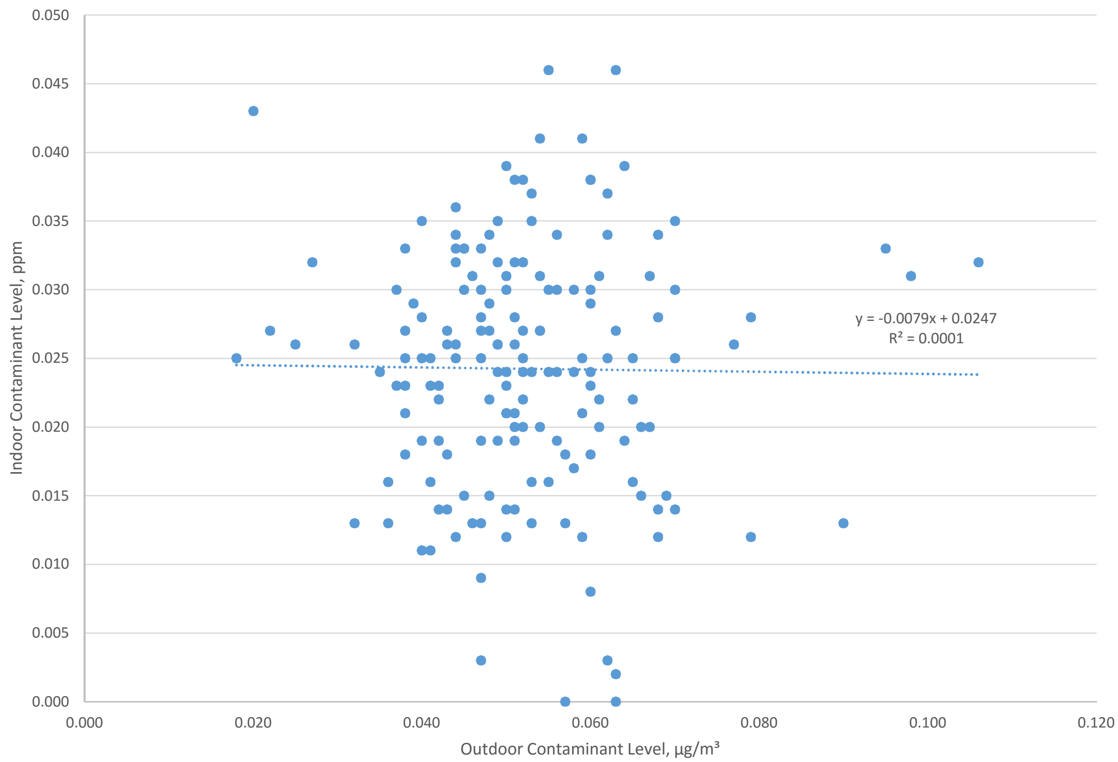

Figure E-3. NO_2, indoor vs outdoor contaminant levels.

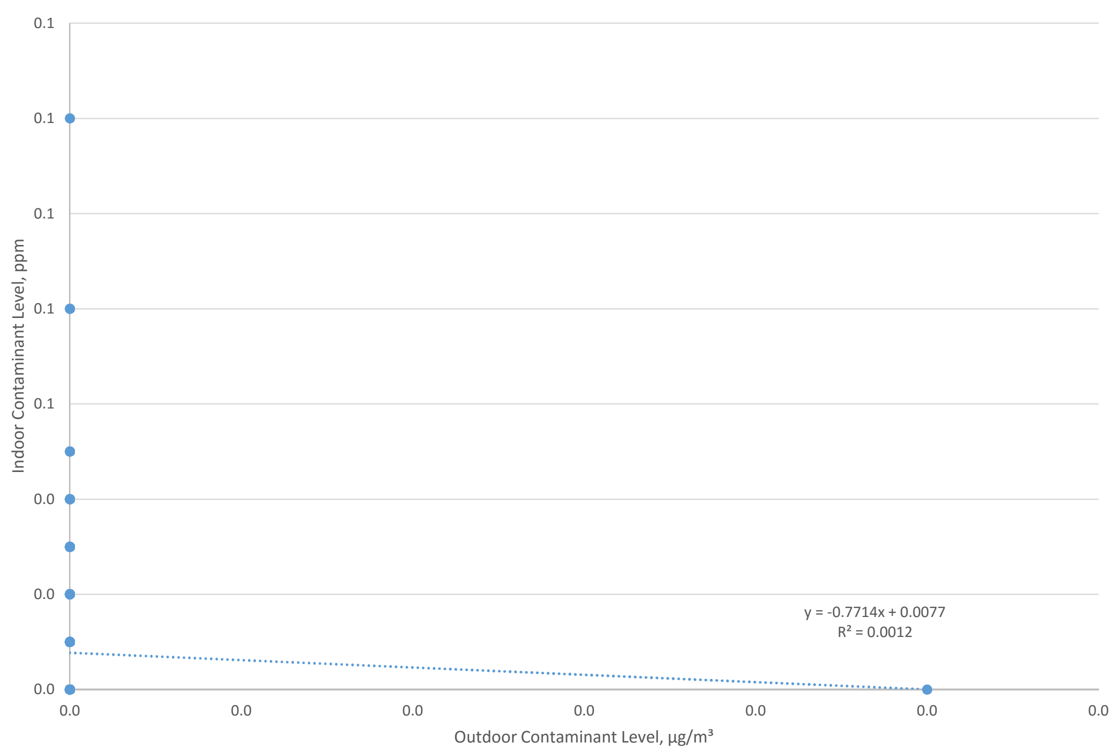

Figure E-4. SO_2, indoor vs outdoor contaminant levels.

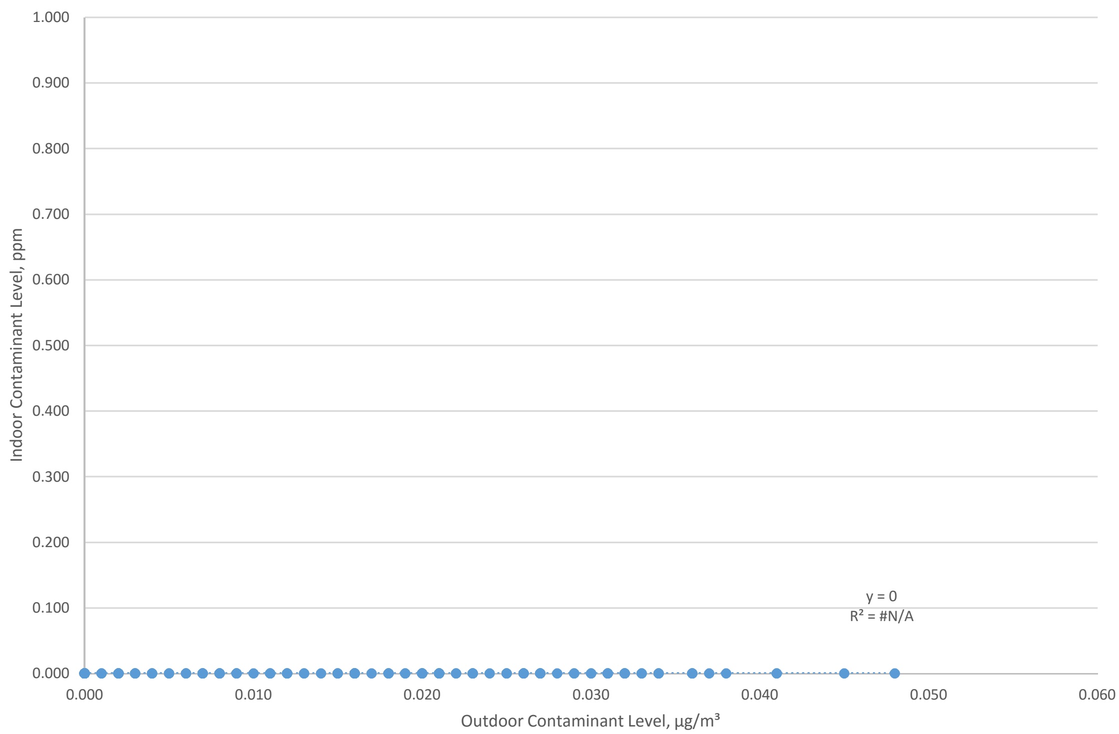

Figure E-5. O_3, indoor vs outdoor contaminant levels.

Appendix F – Graphs by Contaminant, I/O Ratio

Graphs present data as an I/O ratio per contaminant type. Axes were not forced to any value. SO_2 was not included as outdoor values were 0 ppm and mathematical rules prevent division by 0. O_3 was not included as indoor values were 0 ppm and the resulting I/O ration would only be 0. CO was not included because of the all indoor and outdoor values were 0 ppm. I/O ratios were not actively used in this study, but have been included due to the pervasive use of this graph type in the studies reviewed in preparation of this study.

Figure F-1. $PM_{2.5}$, I/O ratio.

Figure F-2. PM_{10}, I/O ratio.

Figure F-3. NO_2, I/O ratio.

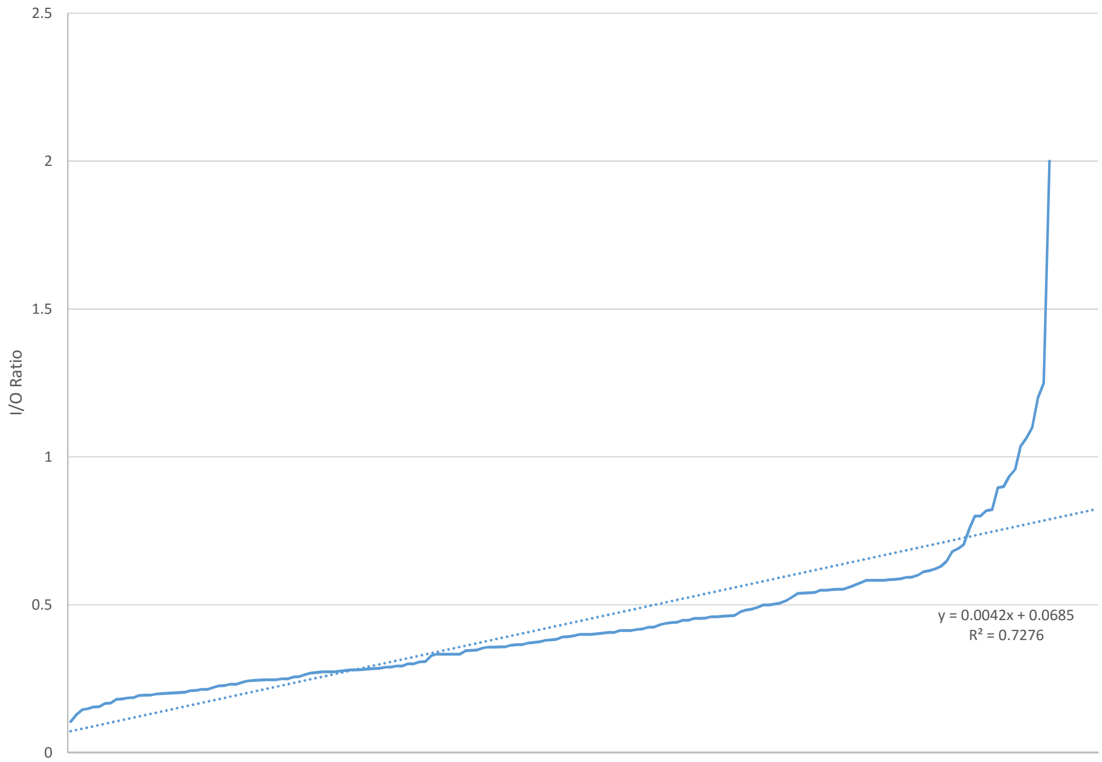

Figure F-1. $PM_{2.5}$, I/O ratio.

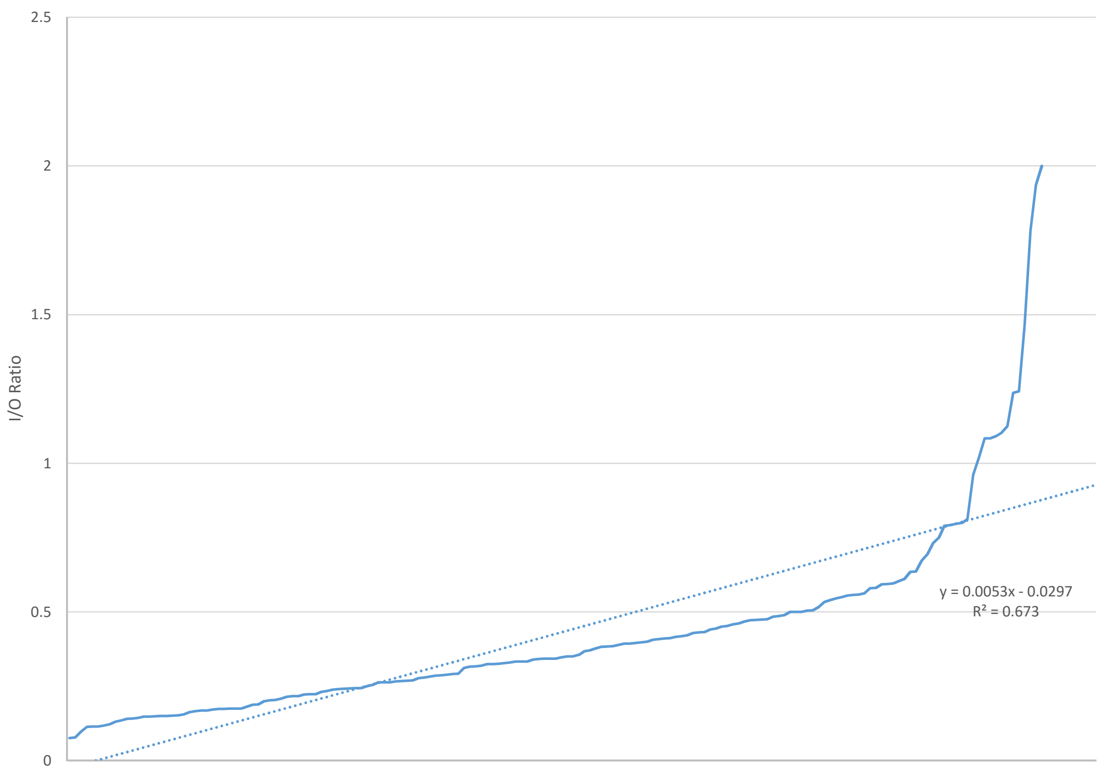

Figure F-2. PM_{10}, I/O ratio.

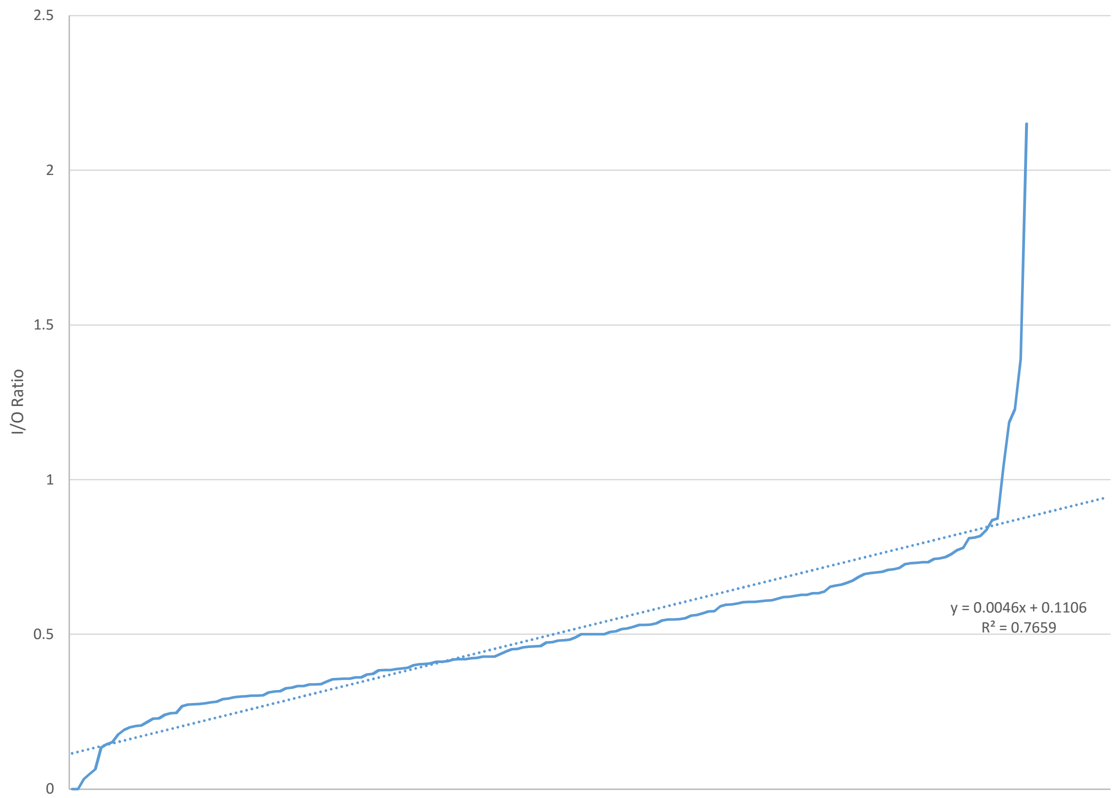

Figure F-3. NO_2, I/O ratio.

Appendix G – Graphs of $PM_{2.5}$

Graphs present $PM_{2.5}$ data per location and either indoor values, outdoor values, indoor versus outdoor values, or I/O ratio. Graphs of indoor and outdoor values include EPA limits for comparison. The primary limit averaged over one year is 12.0 µg/m³. The secondary limit averaged over 1 year is 15.0 µg/m³. The primary and secondary limits averaged over 24 hours are 35 µg/m³. Note that the data on these graphs have not been averaged according to the times suggested: they are presented only as points in time. EPA limits are only applicable to outdoor contaminant levels and have only been presented on indoor graphs for reference. The indoor and outdoor graphs have y-axes forced from 0 to 40 µg/m³. No limits were exceeded indoors at any location during this study. Primary and secondary limits averaged over one year were exceeded in the outdoor samples at some point in time at all locations. Primary and secondary limits averaged over 24 hours were not exceeded by any locations during this study. Graphs presenting data as indoor versus outdoor contaminant levels have forced y-axes of 0 to 16 µg/m³ and x-axes of 25 µg/m³. Graphs presenting data as an I/O ratio have forced y-axes of 2.5.

Figure G-1. $PM_{2.5}$, Location A, indoor.

Figure G-2. $PM_{2.5}$, Location B, indoor.

Figure G-3. $PM_{2.5}$, Location C, indoor.

Figure G-4. $PM_{2.5}$, Location D, indoor.

Figure G-5. $PM_{2.5}$, Location E, indoor.

Figure G-6. $PM_{2.5}$, Location A, outdoor.

Figure G-7. $PM_{2.5}$, Location B, outdoor.

Figure G-8. $PM_{2.5}$, Location C, outdoor.

Figure G-9. $PM_{2.5}$, Location D, outdoor.

Figure G-10. $PM_{2.5}$, Location E, outdoor.

Figure G-11. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location A.

Figure G-12. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location B.

Figure G-13. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location C.

Figure G-14. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location D.

Figure G-15. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location E.

Figure G-16. $PM_{2.5}$, I/O ratio, Location A.

Figure G-17. $PM_{2.5}$, I/O ratio, Location B.

Figure G-18. $PM_{2.5}$, I/O ratio, Location C.

Figure G-19. $PM_{2.5}$, I/O ratio, Location D.

Figure G-20. $PM_{2.5}$, I/O ratio, Location E.

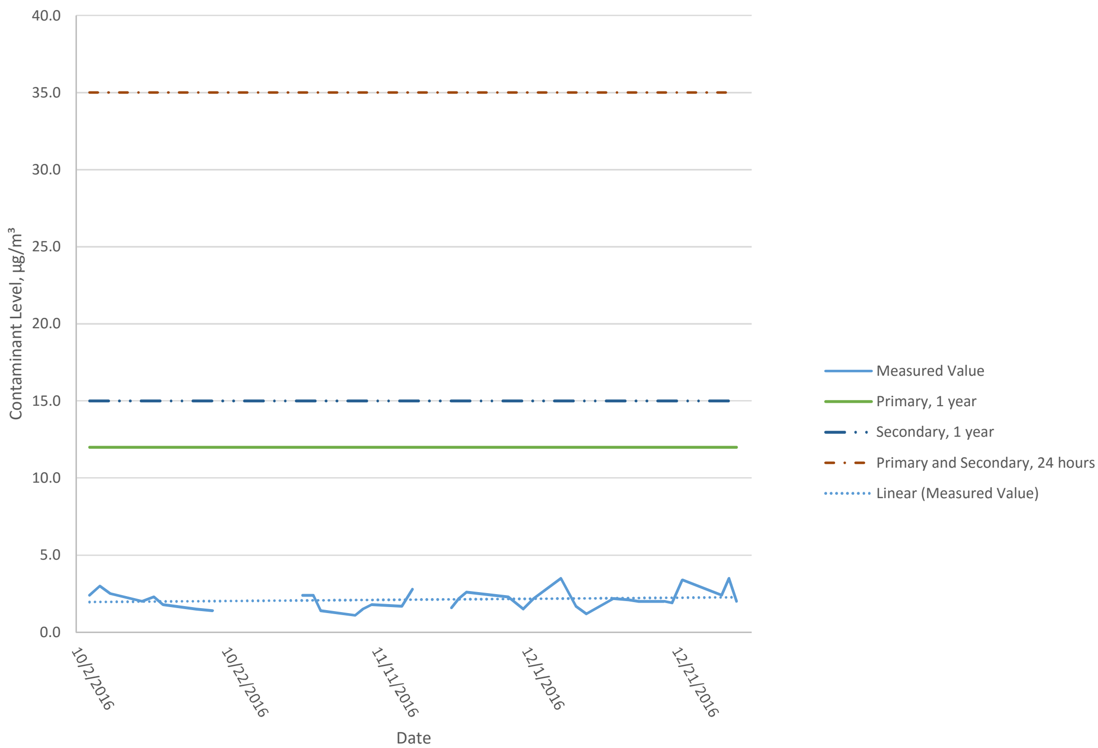

Figure G-1. $PM_{2.5}$, Location A, indoor.

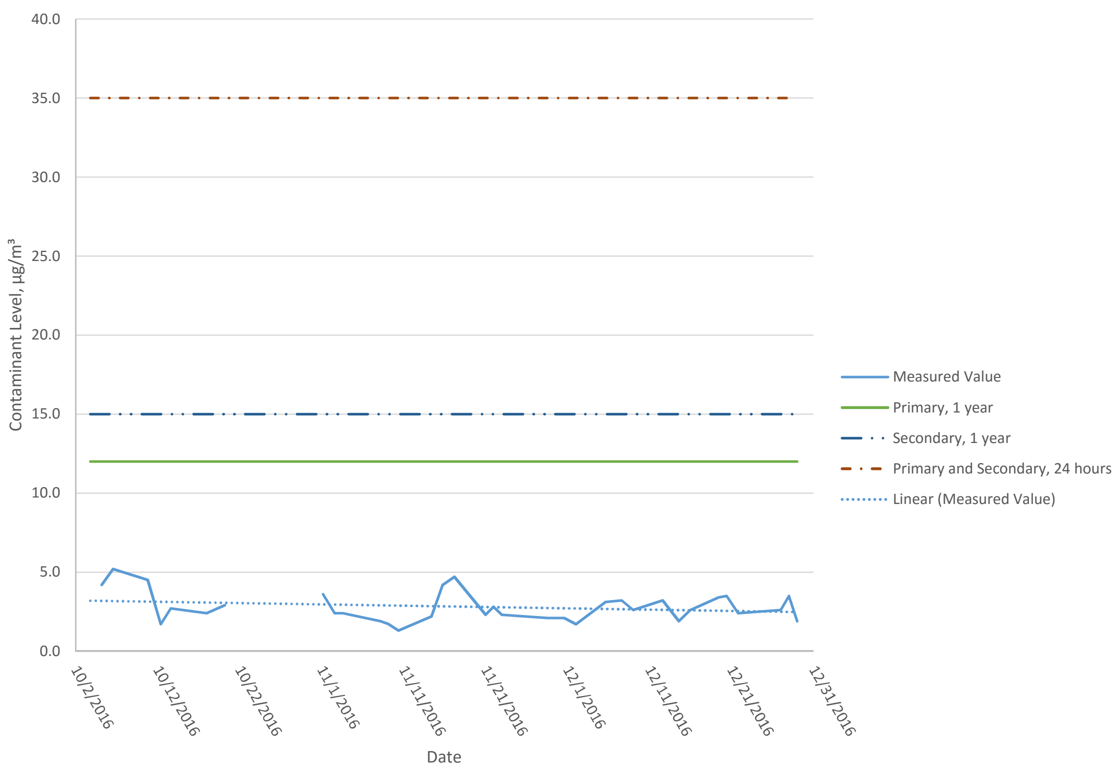

Figure G-2. $PM_{2.5}$, Location B, indoor.

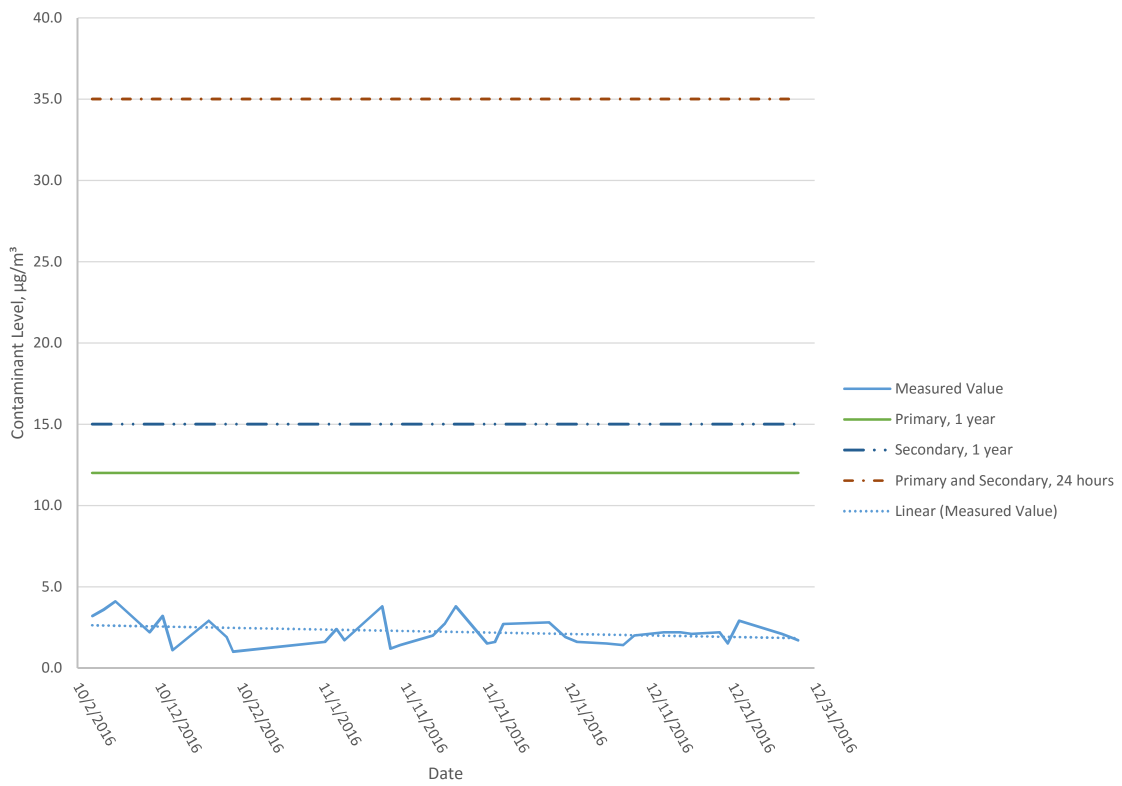

Figure G-3. $PM_{2.5}$, Location C, indoor.

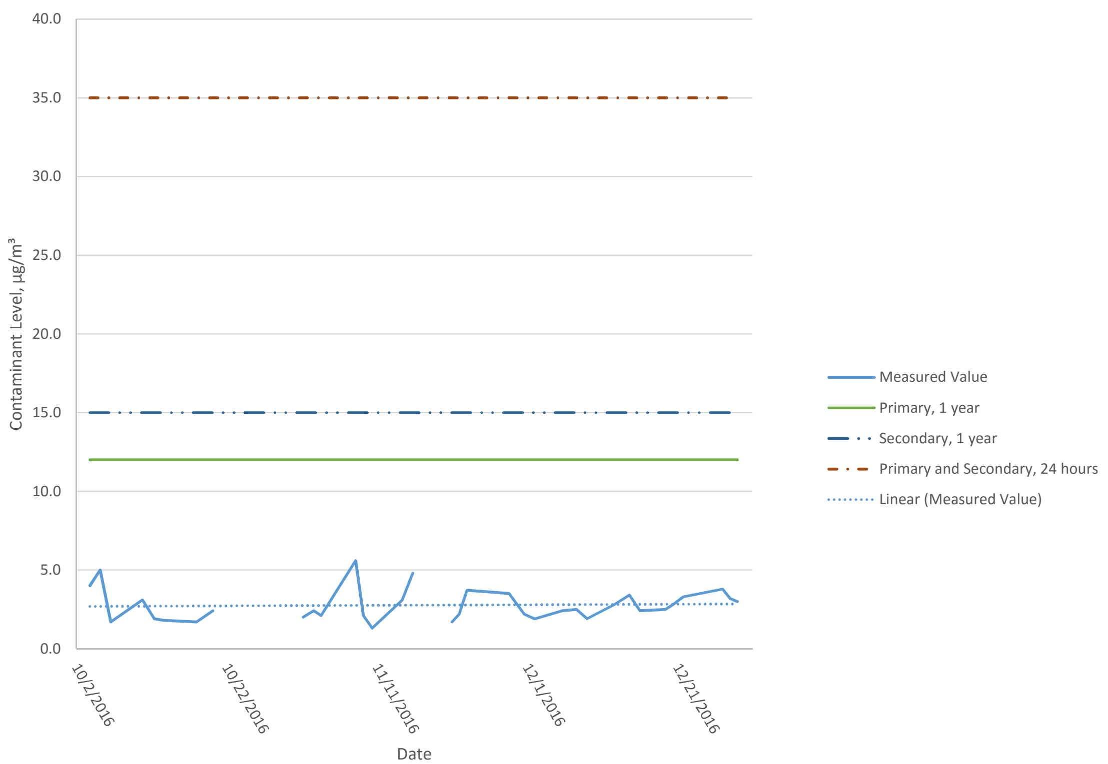

Figure G-4. $PM_{2.5}$, Location D, indoor.

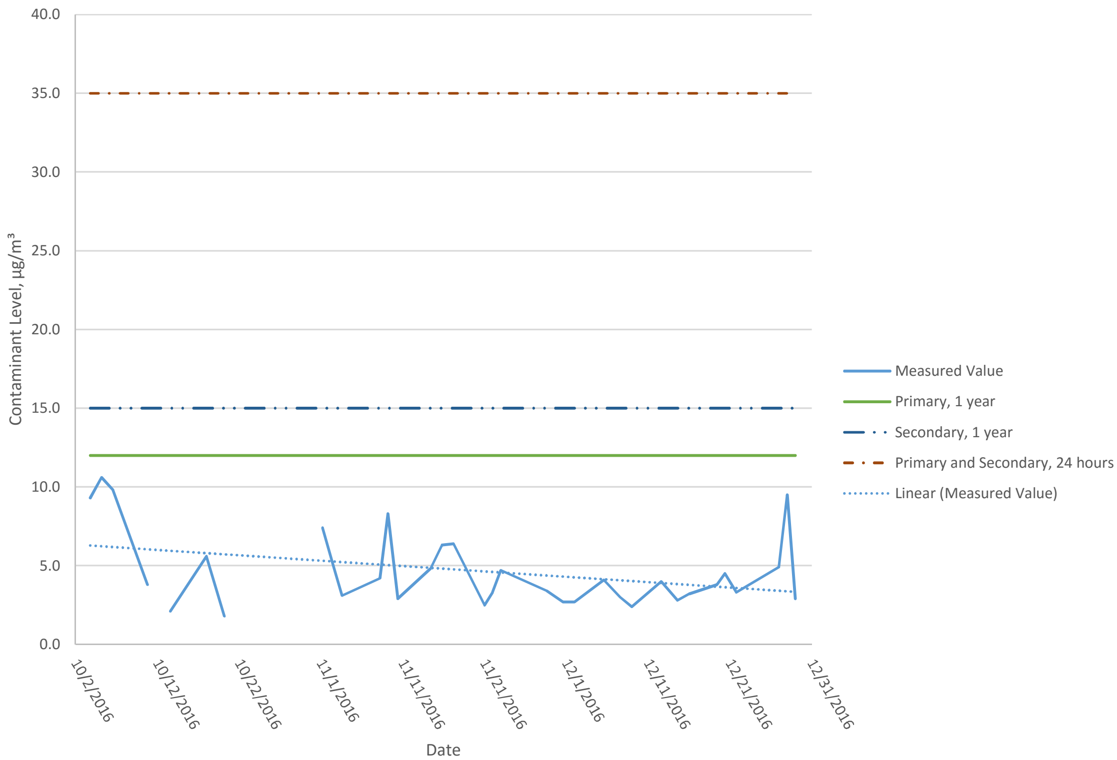

Figure G-5. $PM_{2.5}$, Location E, indoor.

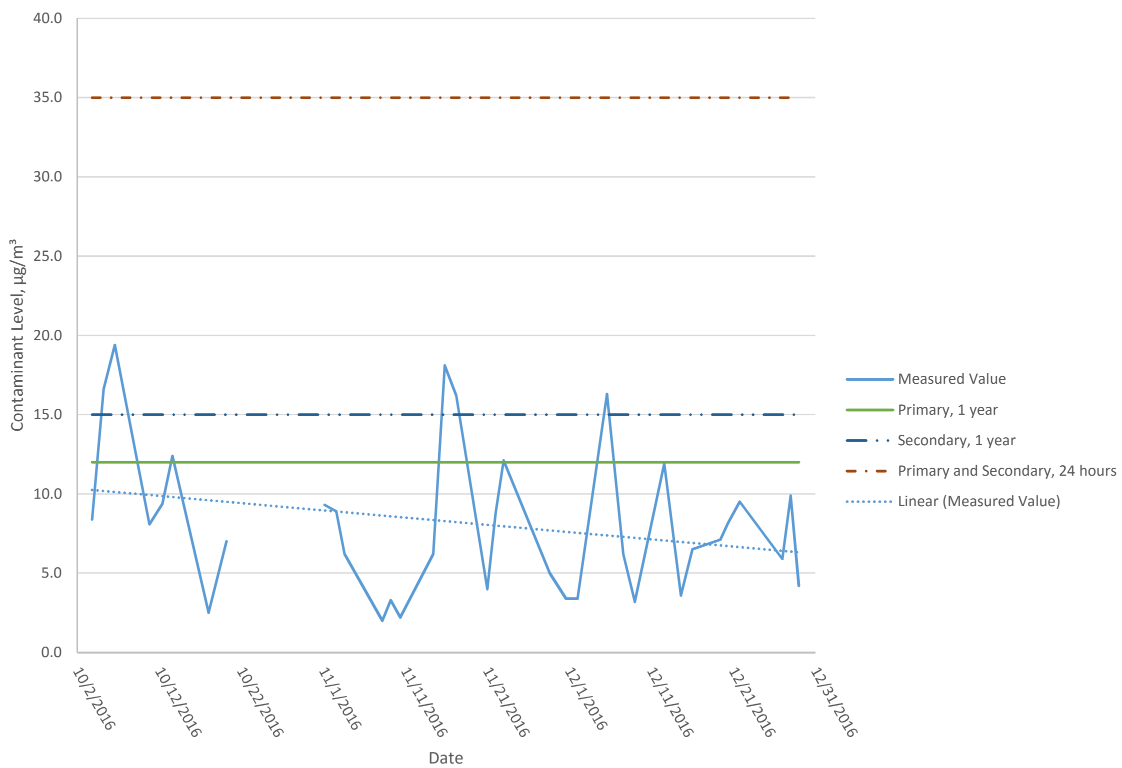

Figure G-6. $PM_{2.5}$, Location A, outdoor.

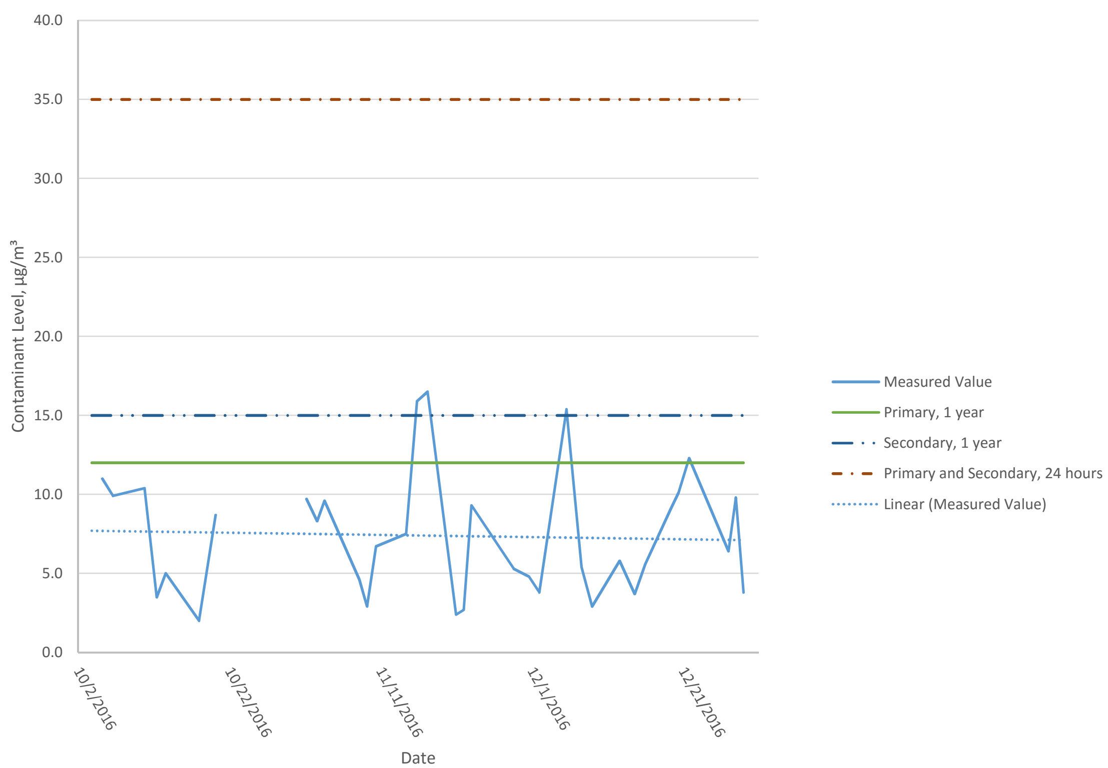

Figure G-7. $PM_{2.5}$, Location B, outdoor.

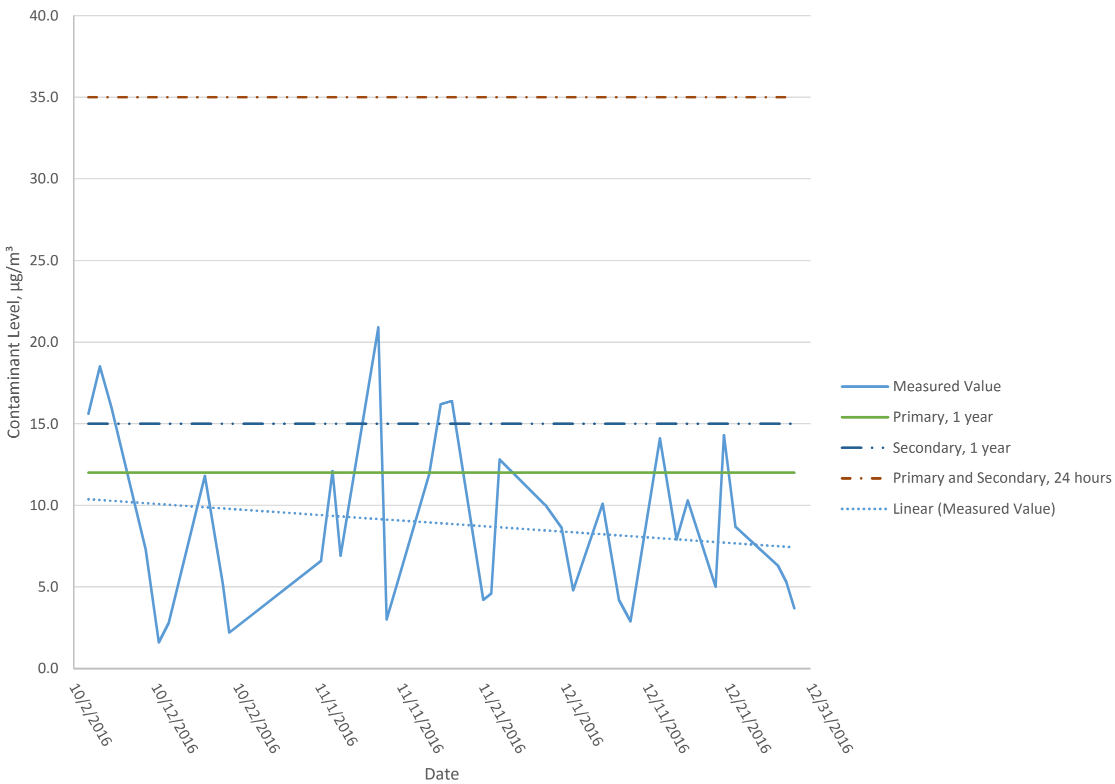

Figure G-8. $PM_{2.5}$, Location C, outdoor.

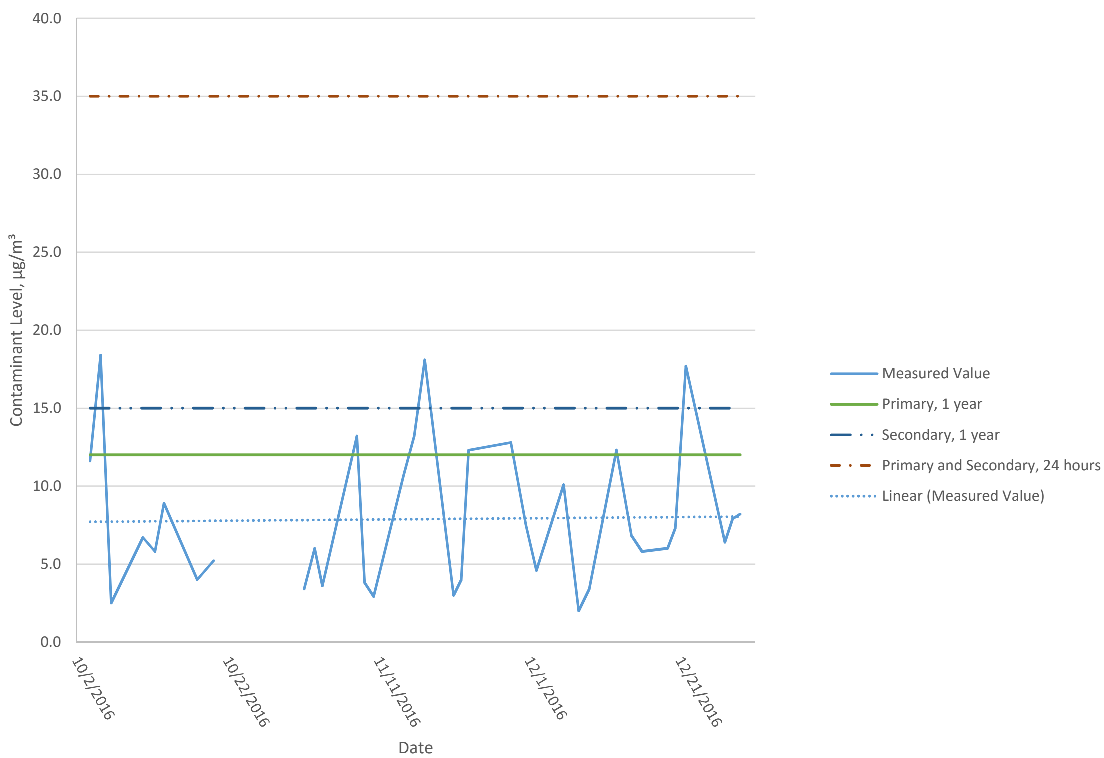

Figure G-9. $PM_{2.5}$, Location D, outdoor.

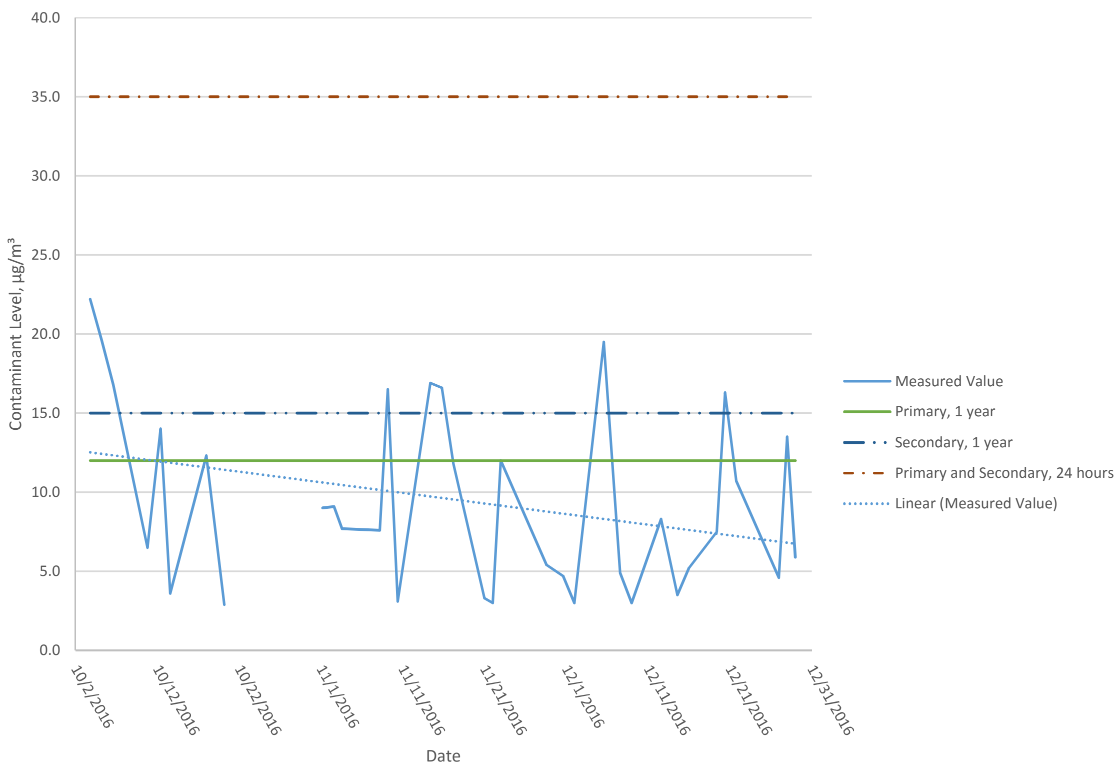

Figure G-10. $PM_{2.5}$, Location E, outdoor.

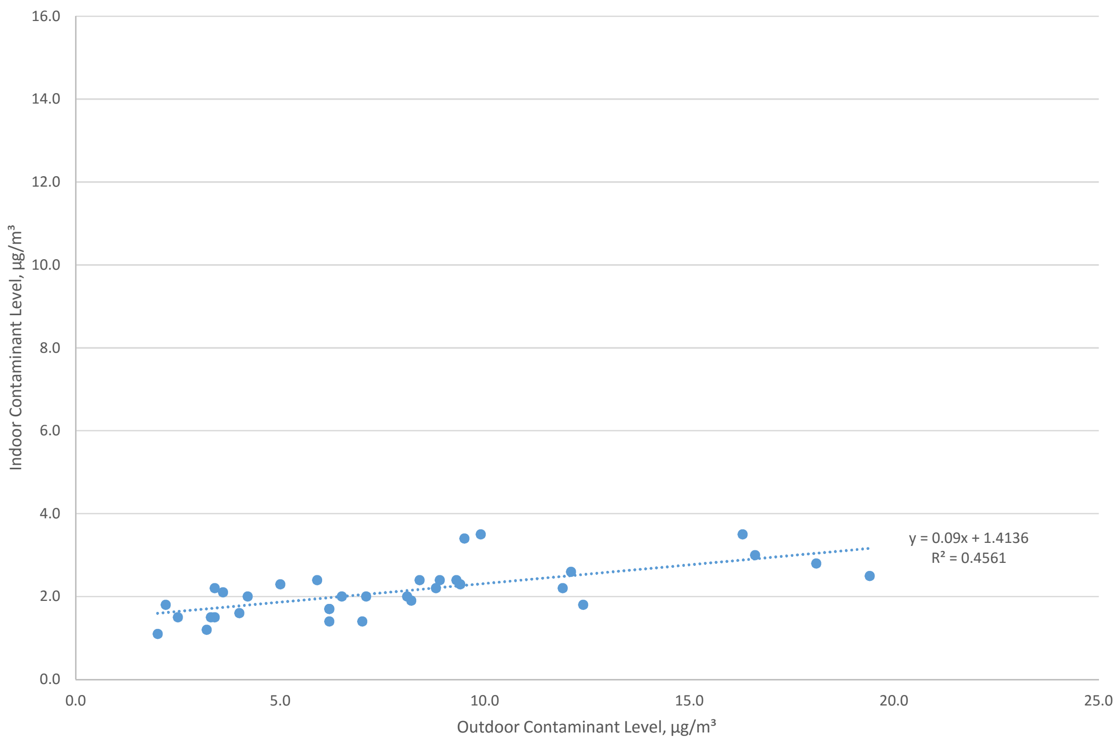

Figure G-11. PM$_{2.5}$, indoor vs outdoor contaminant levels, Location A.

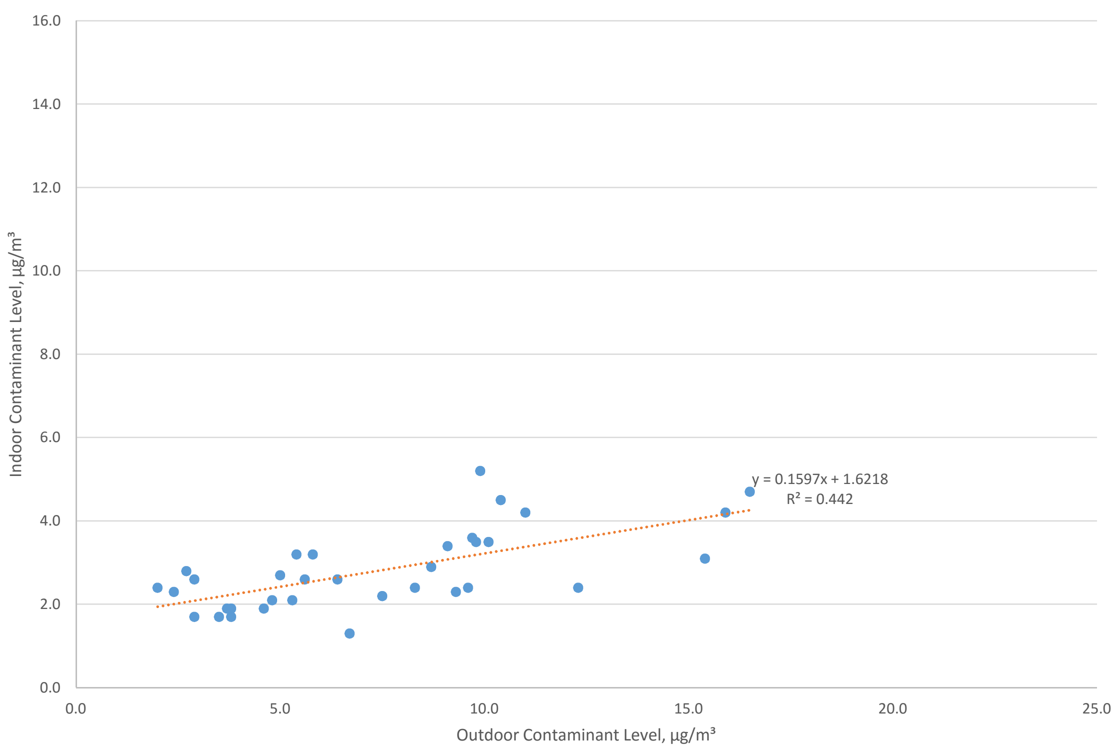

Figure G-12. PM$_{2.5}$, indoor vs outdoor contaminant levels, Location B.

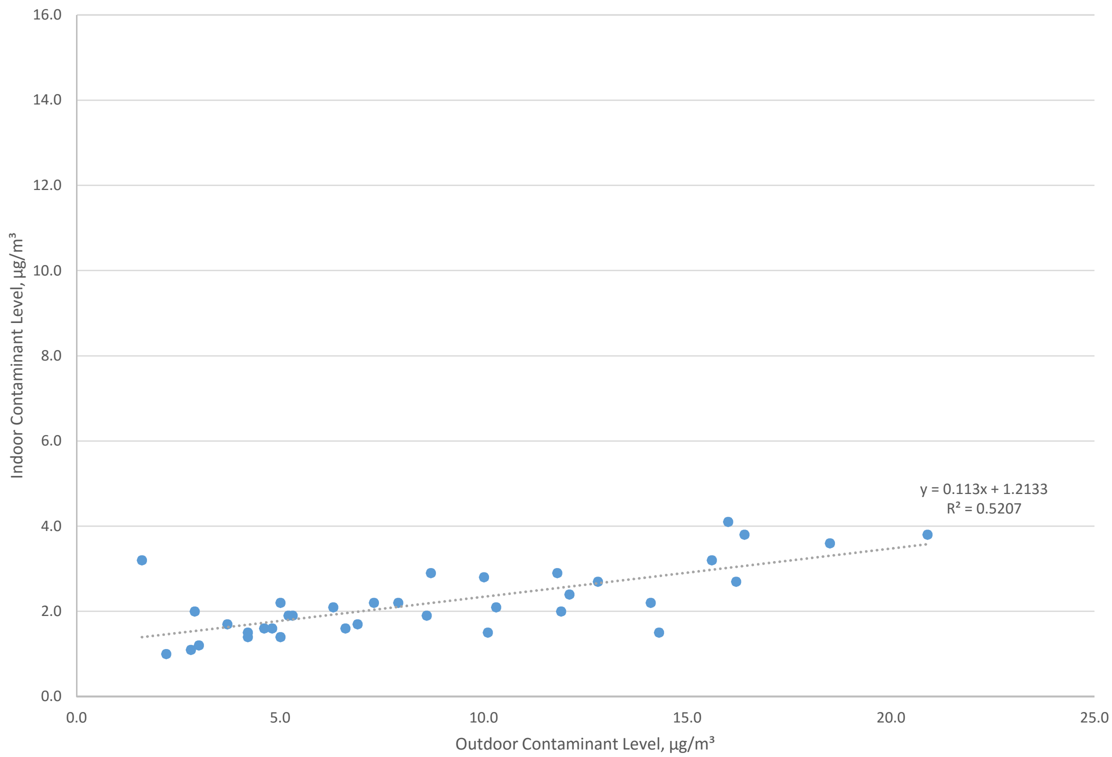

Figure G-13. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location C.

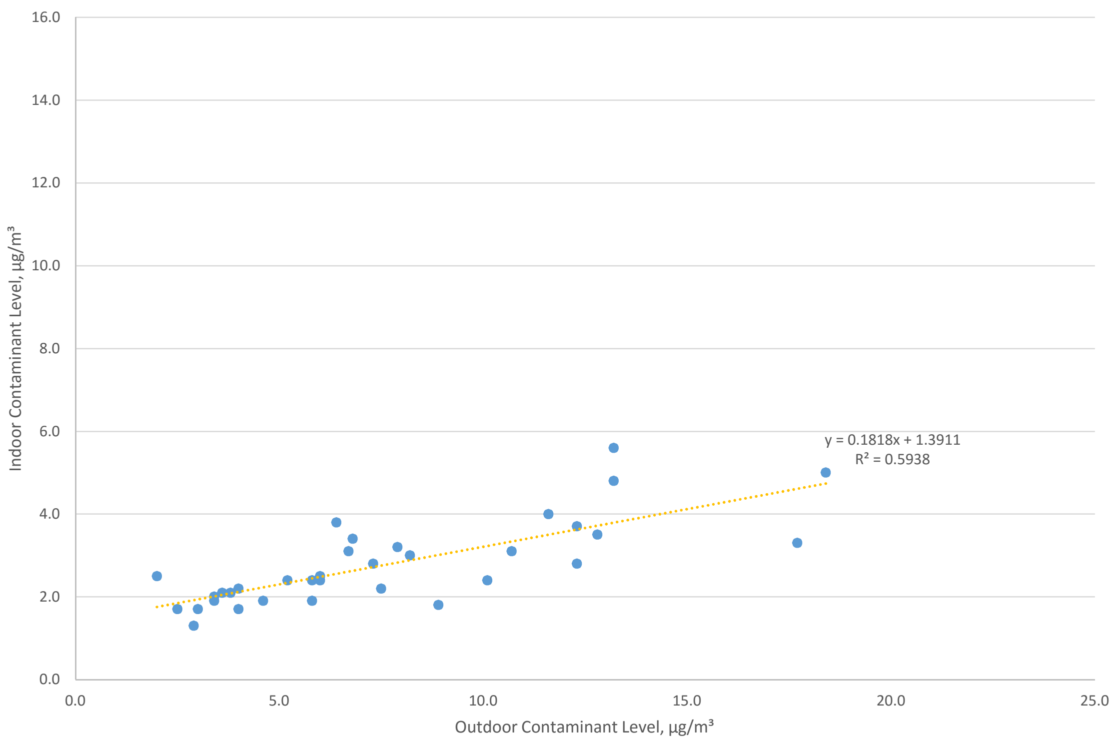

Figure G-14. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location D.

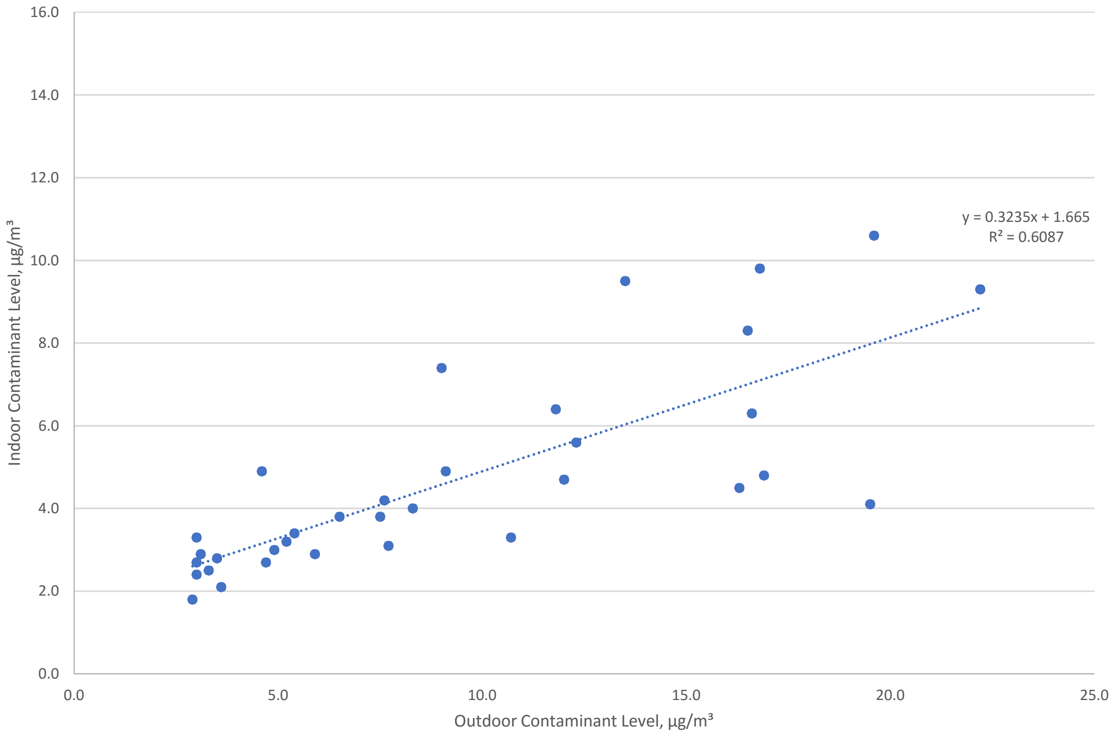

Figure G-15. $PM_{2.5}$, indoor vs outdoor contaminant levels, Location E.

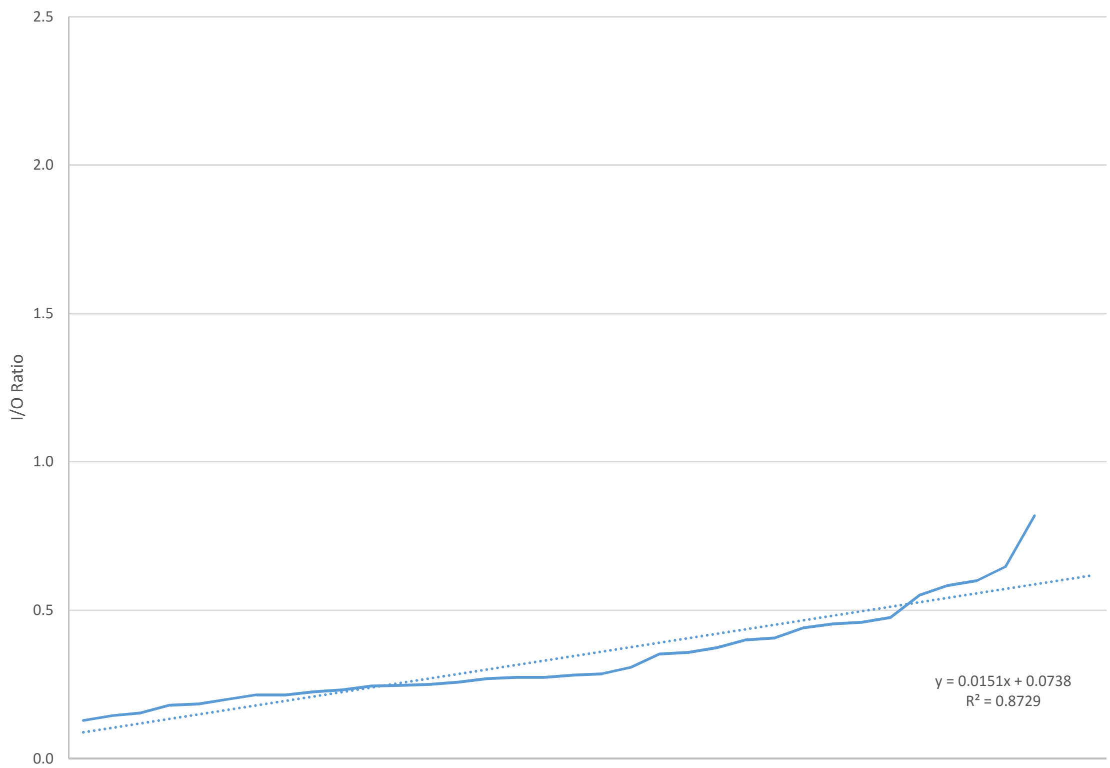

Figure G-16. $PM_{2.5}$, I/O ratio, Location A.

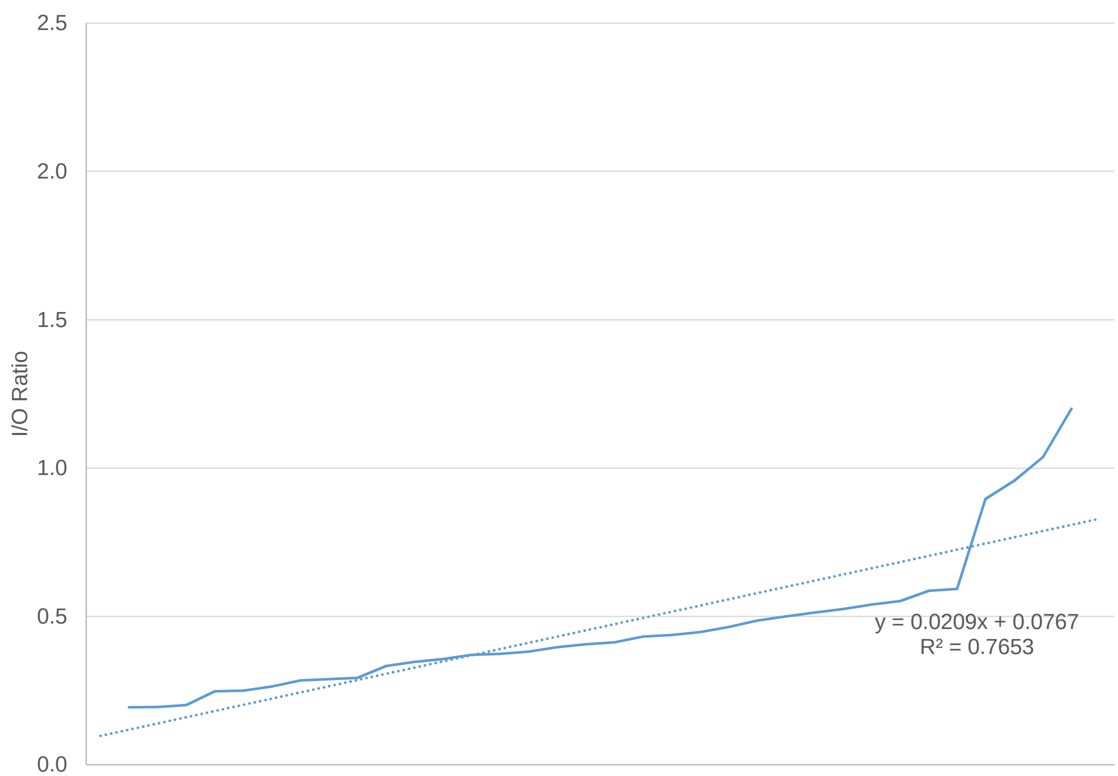

Figure G-17. PM2.5, I/O ratio, Location B.

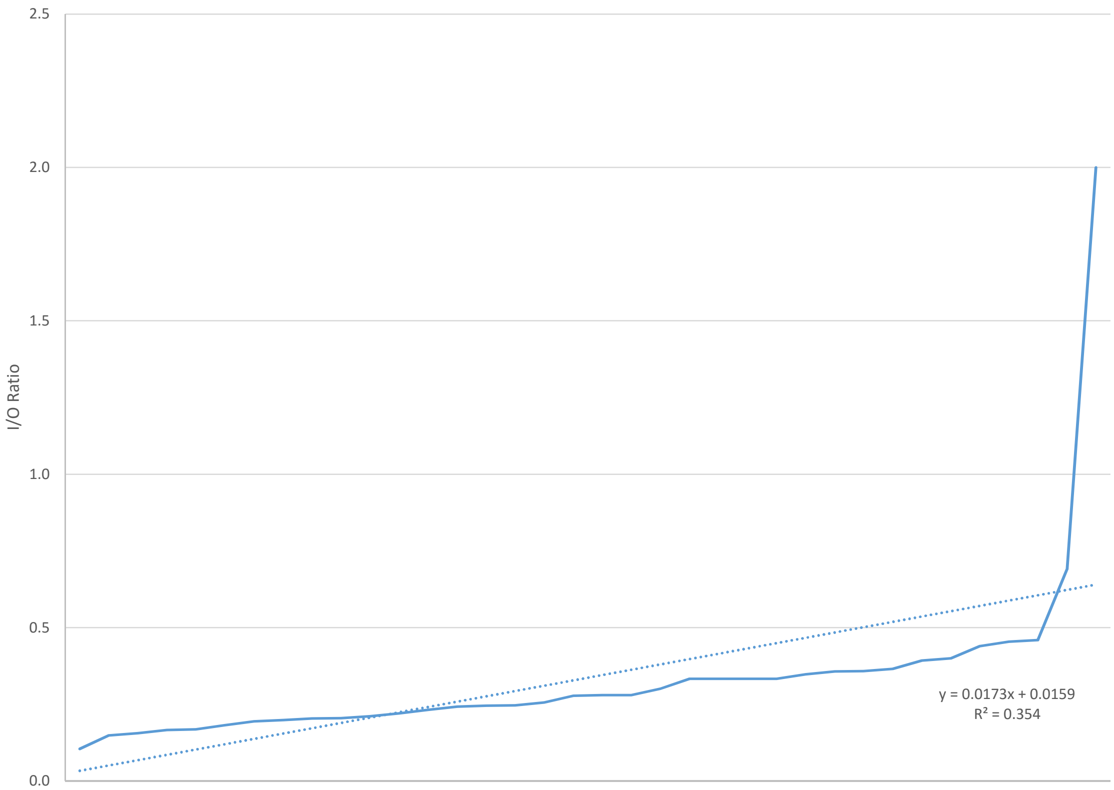

Figure G-18. $PM_{2.5}$, I/O ratio, Location C.

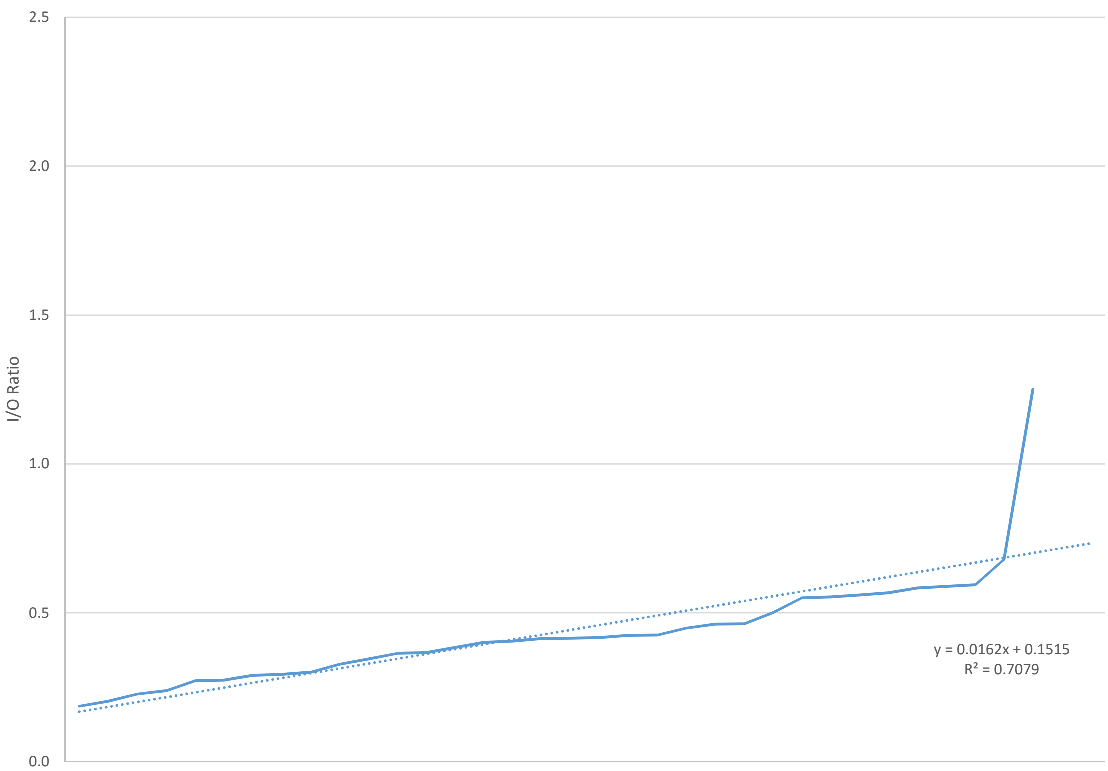

Figure G-19. $PM_{2.5}$, I/O ratio, Location D.

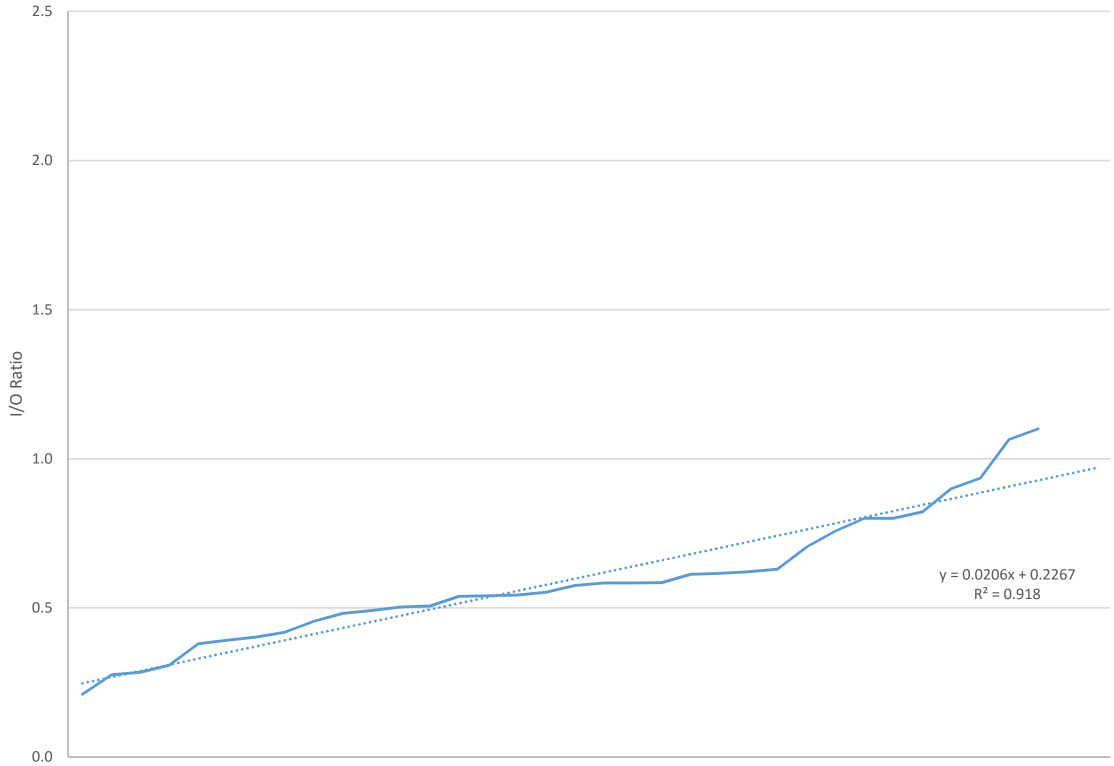

Figure G-20. $PM_{2.5}$, I/O ratio, Location E.

Appendix H – Graphs of PM_{10}

Graphs present PM_{10} data per location and either indoor values, outdoor values, indoor versus outdoor values, or I/O ratio. Graphs of indoor and outdoor values include the primary and secondary EPA limits averaged over 24 hours of 150 $\mu g/m^3$. Note that the data on these graphs have not been averaged: they are only presented as points in time. The EPA limit is only applicable to the outdoor contaminant levels and have only been presented on indoor graphs for reference. The indoor and outdoor graphs have y-axes forced from 0 to 160 $\mu g/m^3$. No limits were exceeded indoors or outdoors at any location during this study. Graphs presenting data as indoor versus outdoor contaminant levels have forced y-axes of 16 $\mu g/m^3$ and x-axes of 35 $\mu g/m^3$. Graphs presenting data as an I/O ratio have forced y-axes of 2.5.

Figure H-1. PM_{10}, Location A, indoor.

Figure H-2. PM_{10}, Location B, indoor.

Figure H-3. PM_{10}, Location C, indoor.

Figure H-4. PM_{10}, Location D, indoor.

Figure H-5. PM_{10}, Location E, indoor.

Figure H-6. PM_{10}, Location A, outdoor.

Figure H-7. PM_{10}, Location B, outdoor.

Figure H-8. PM_{10}, Location C, outdoor.

Figure H-9. PM_{10}, Location D, outdoor.

Figure H-10. PM_{10}, Location E, outdoor.

Figure H-11. PM_{10}, indoor vs outdoor contaminant levels, Location A.

Figure H-12. PM_{10}, indoor vs outdoor contaminant levels, Location B.

Figure H-13. PM_{10}, indoor vs outdoor contaminant levels, Location C.

Figure H-14. PM_{10}, indoor vs outdoor contaminant levels, Location D.

Figure H-15. PM_{10}, indoor vs outdoor contaminant levels, Location E.

Figure H-16. PM_{10}, I/O ratio, Location A.

Figure H-17. PM_{10}, I/O ratio, Location B.

Figure H-18. PM_{10}, I/O ratio, Location C.

Figure H-19. PM_{10}, I/O ratio, Location D.

Figure H-20. PM_{10}, I/O ratio, Location E.

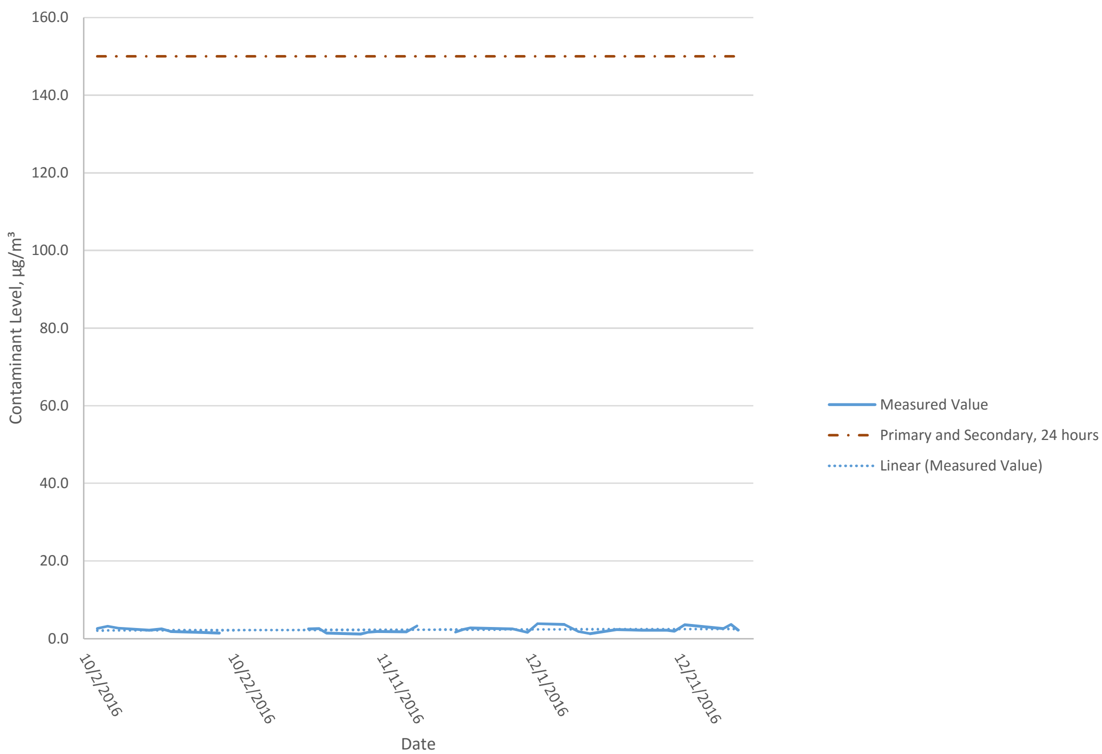

Figure H-1. PM_{10}, Location A, indoor.

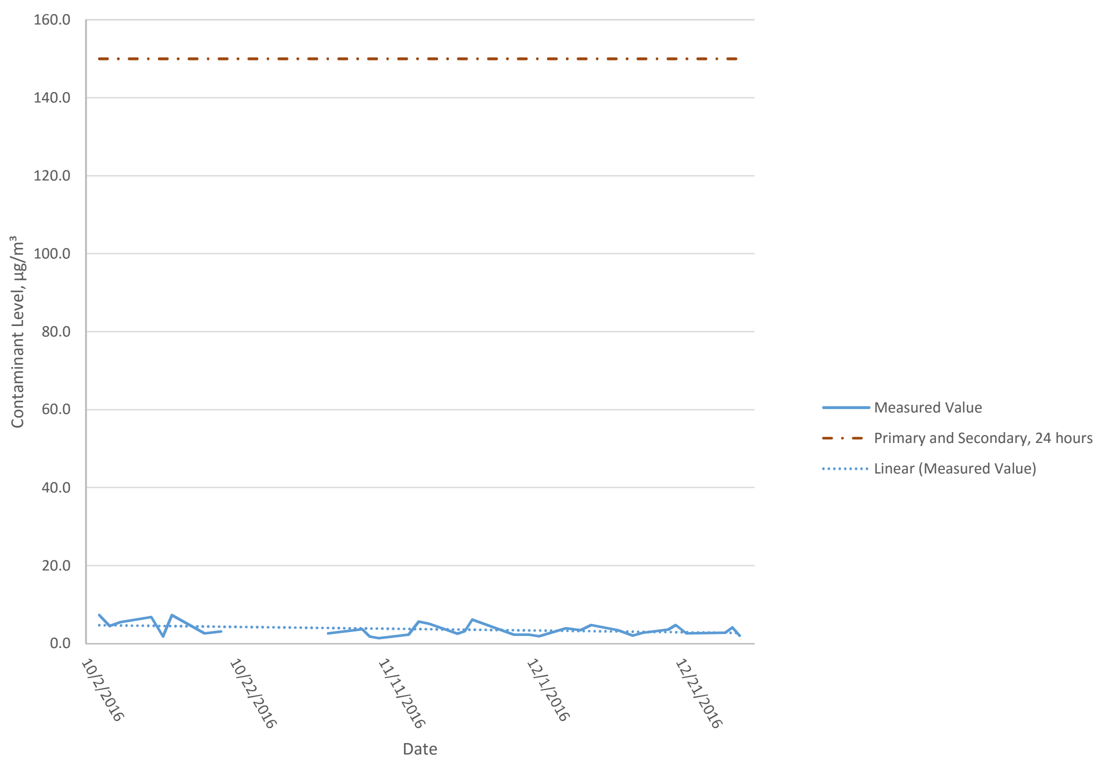

Figure H-2. PM_{10}, Location B, indoor.

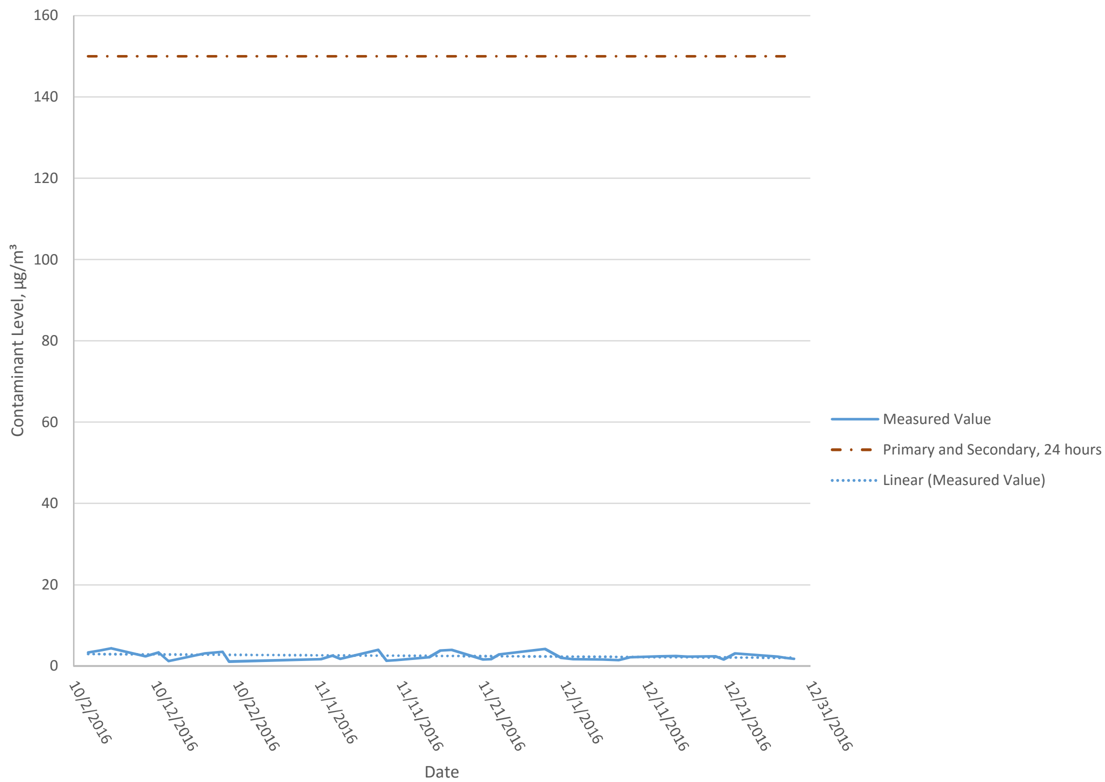

Figure H-3. PM_{10}, Location C, indoor.

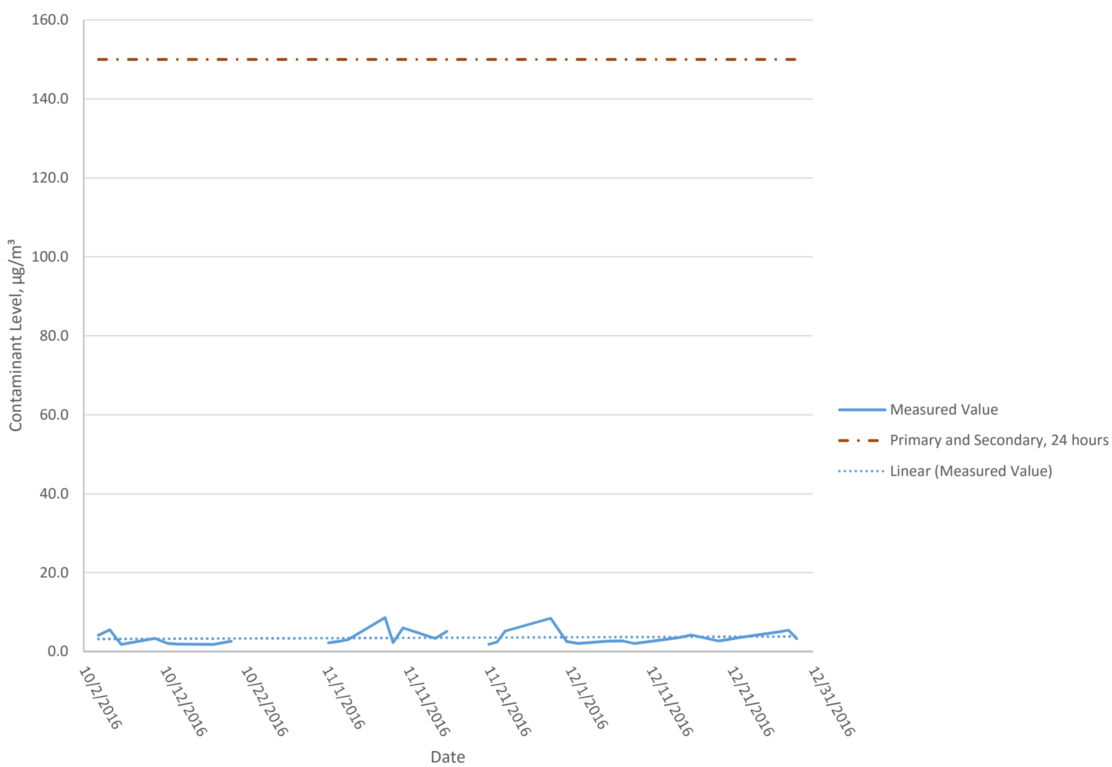

Figure H-4. PM_{10}, Location D, indoor.

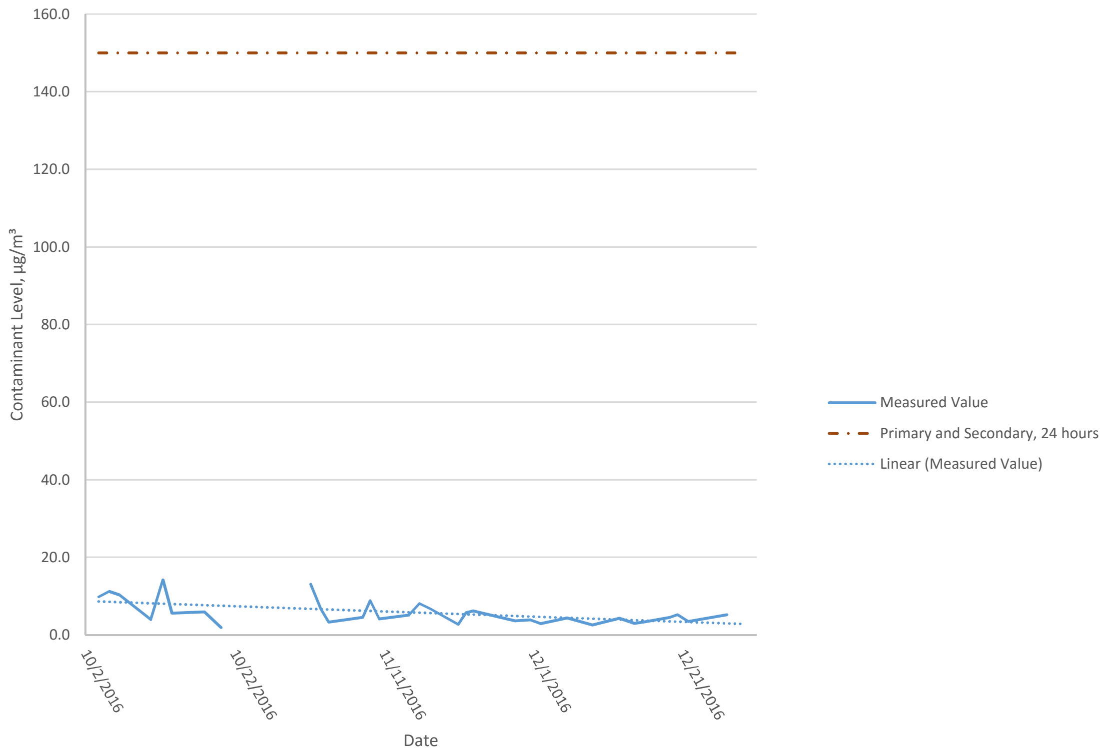

Figure H-5. PM_{10}, Location E, indoor.

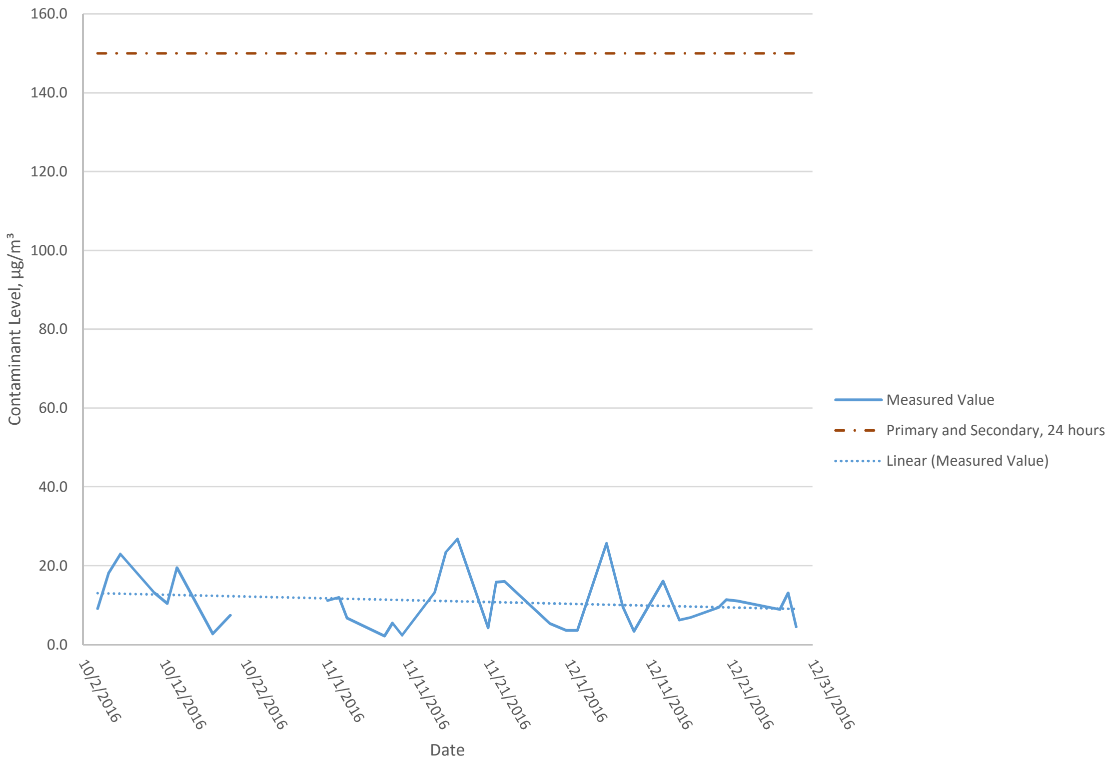

Figure H-6. PM_{10}, Location A, outdoor.

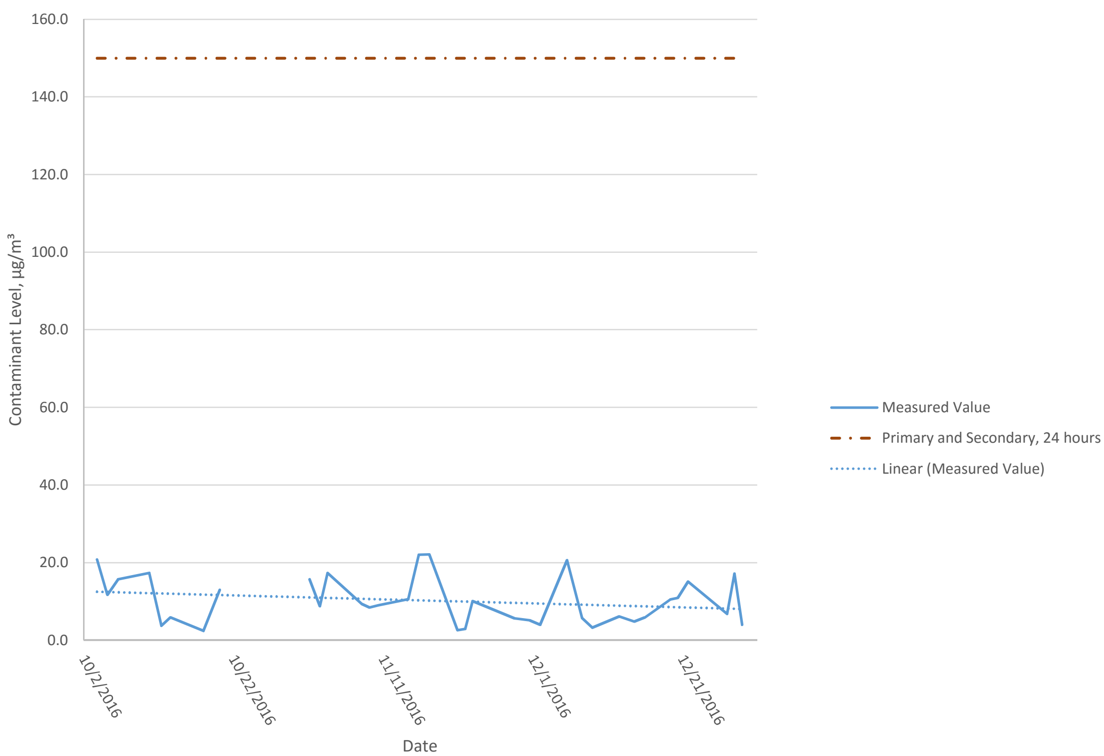

Figure H-7. PM_{10}, Location B, outdoor.

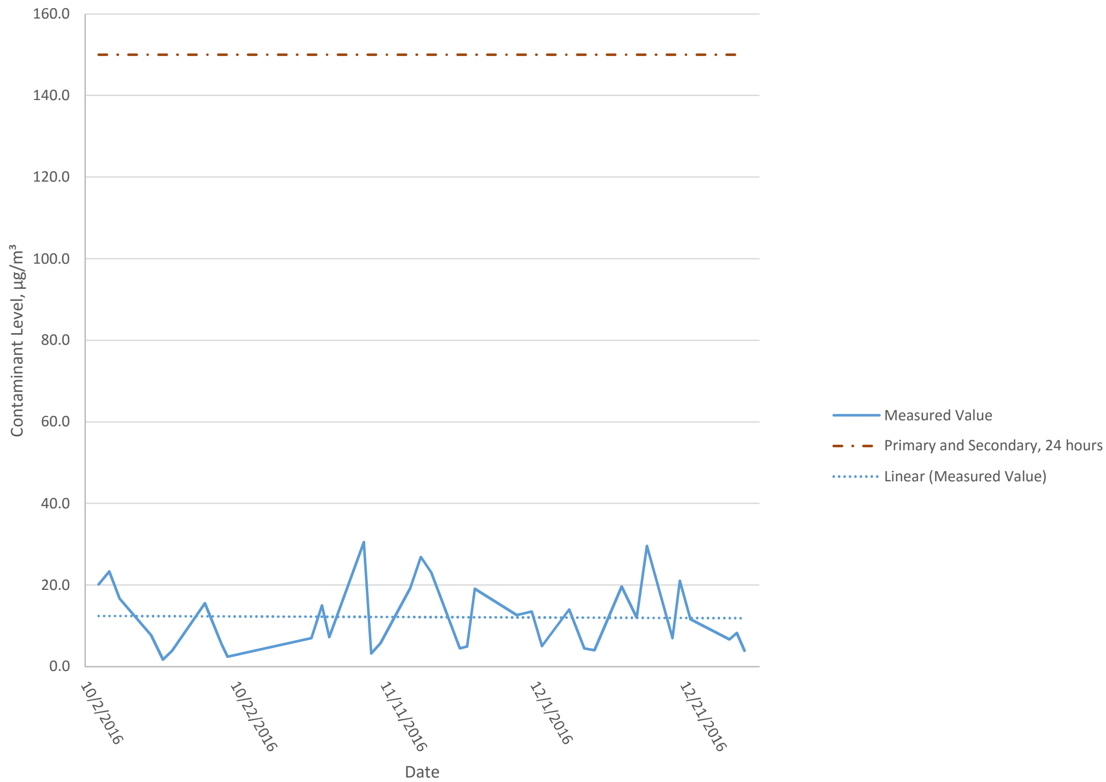

Figure H-8. PM_{10}, Location C, outdoor.

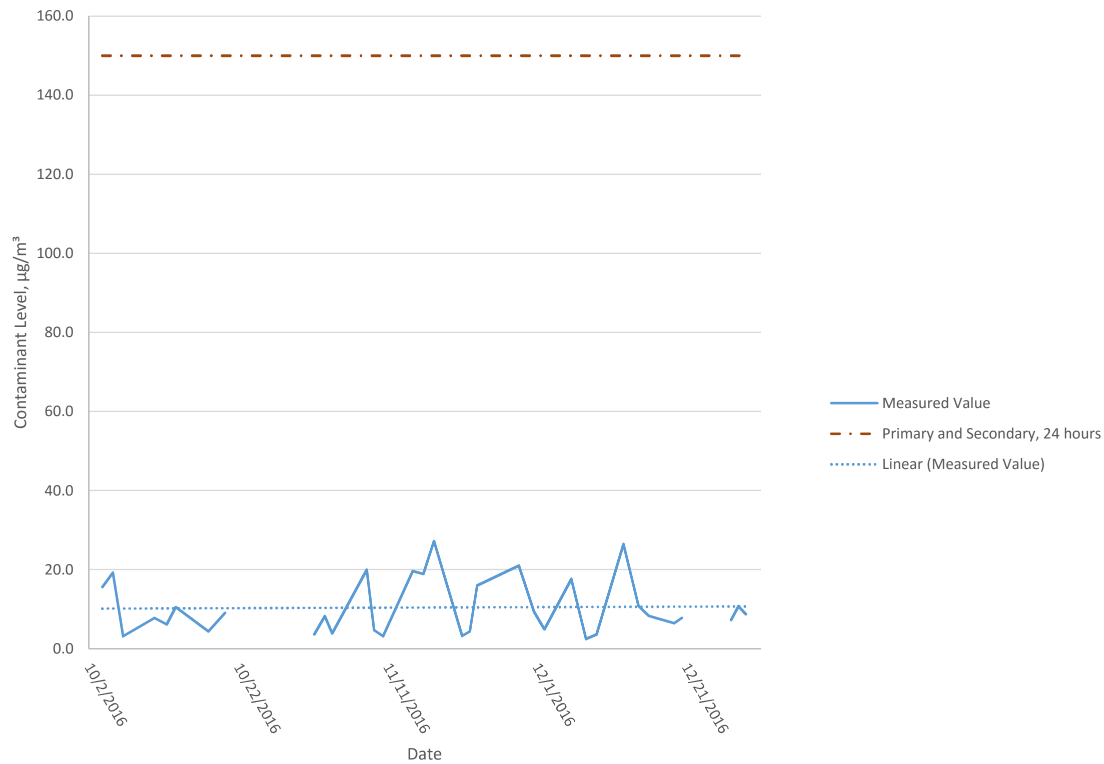

Figure H-9. PM_{10}, Location D, outdoor.

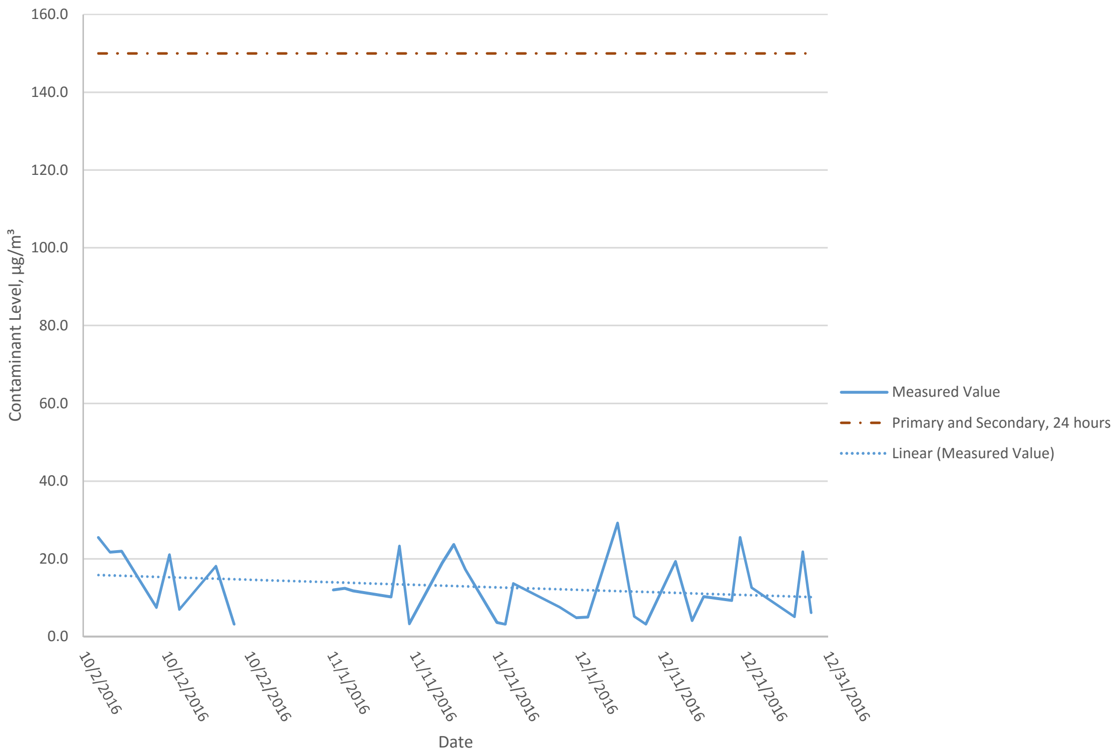

Figure H-10. PM_{10}, Location E, outdoor.

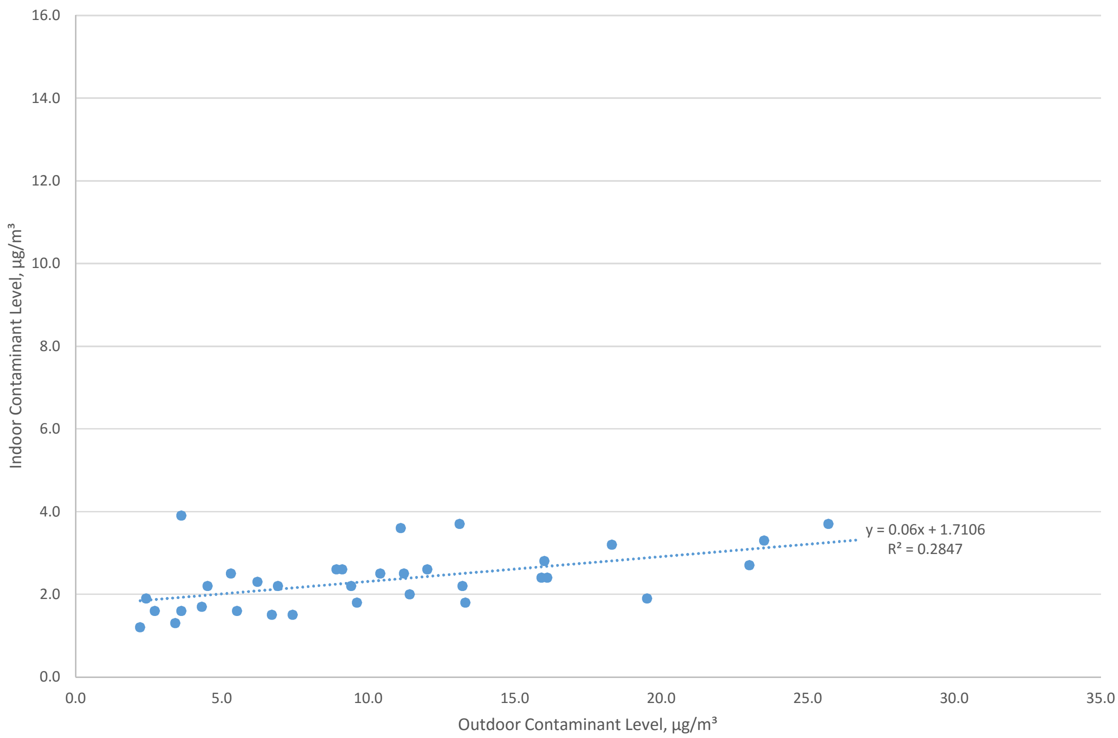

Figure H-11. PM_{10}, indoor vs outdoor contaminant levels, Location A.

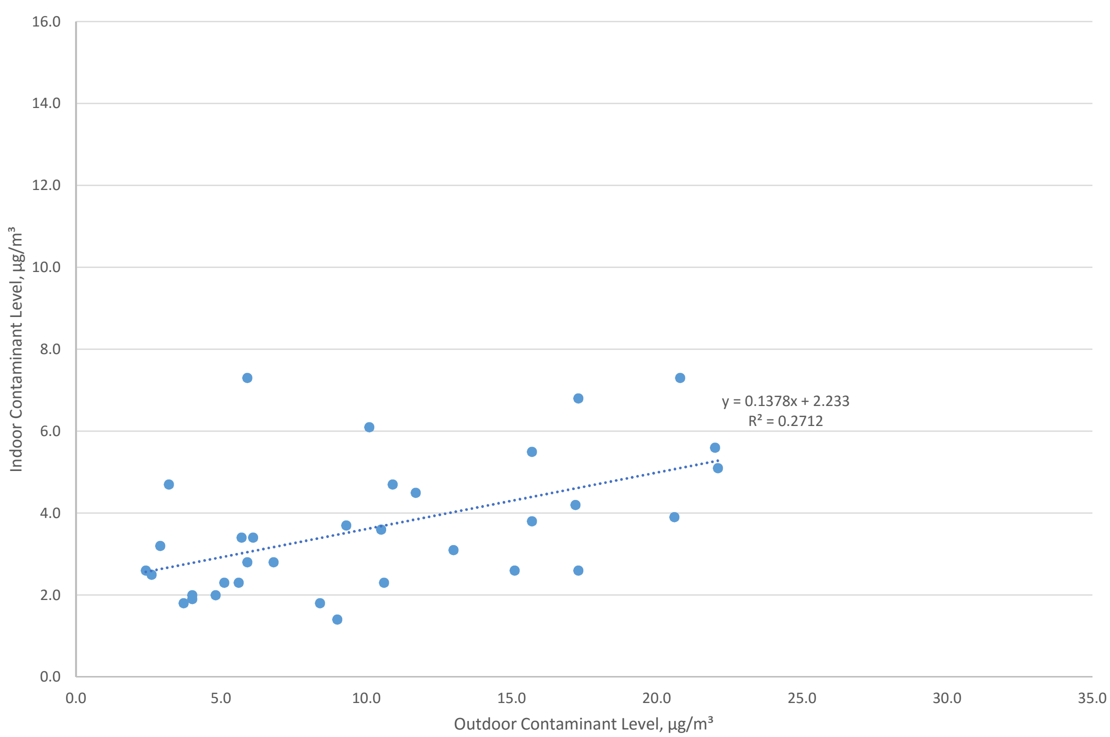

Figure H-12. PM_{10}, indoor vs outdoor contaminant levels, Location B.

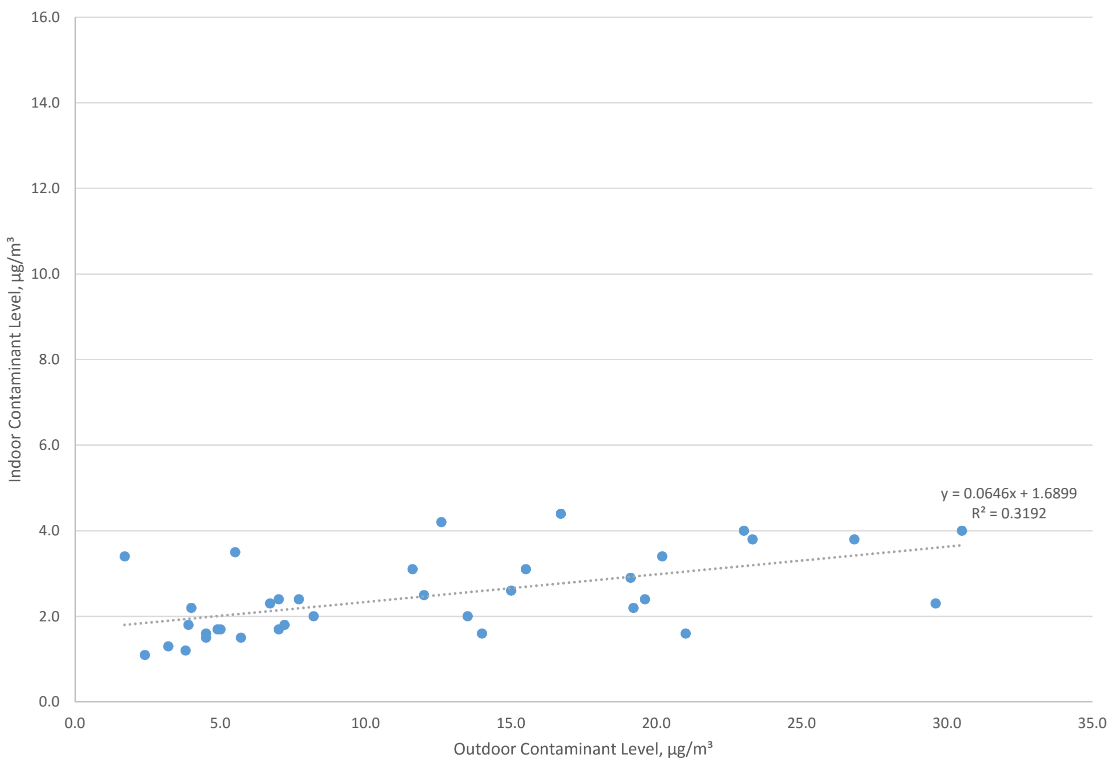

Figure H-13. PM_{10}, indoor vs outdoor contaminant levels, Location C.

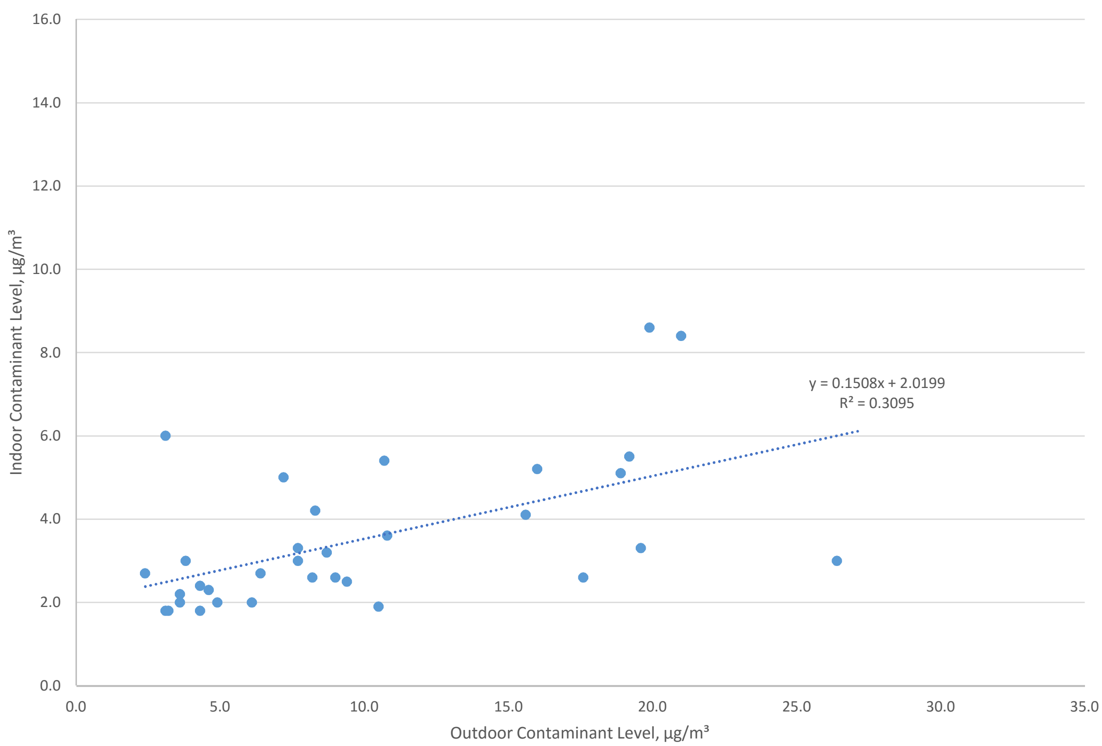

Figure H-14. PM_{10}, indoor vs outdoor contaminant levels, Location D.

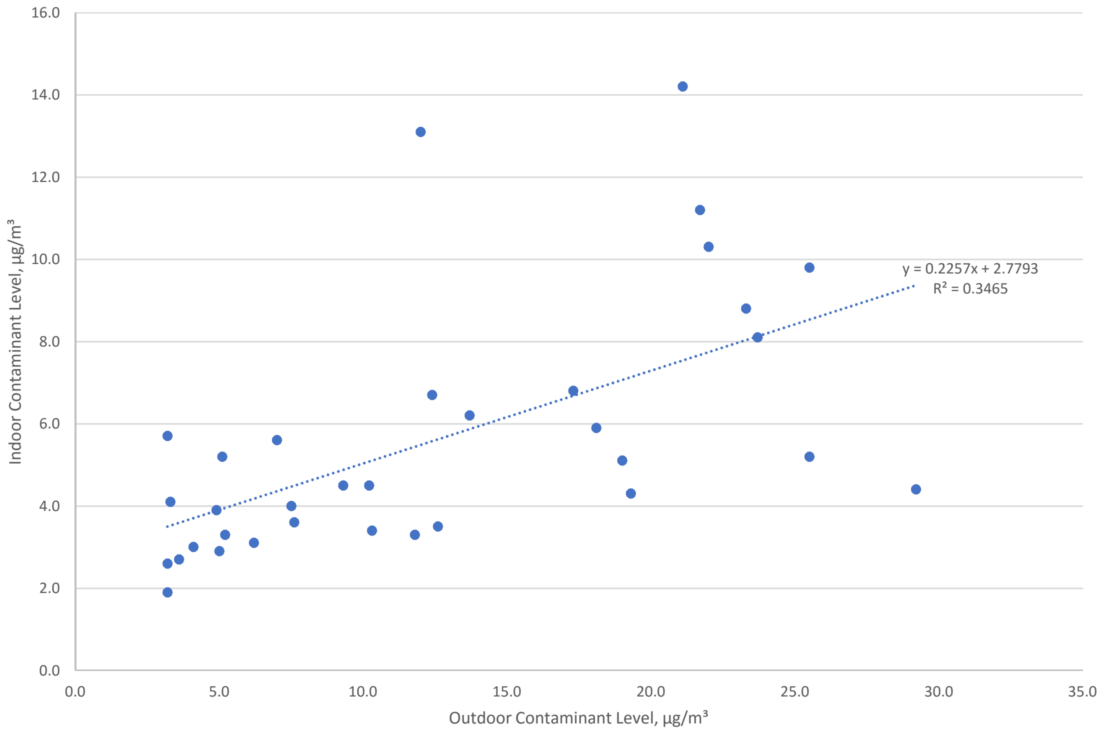

Figure H-15. PM_{10}, indoor vs outdoor contaminant levels, Location E.

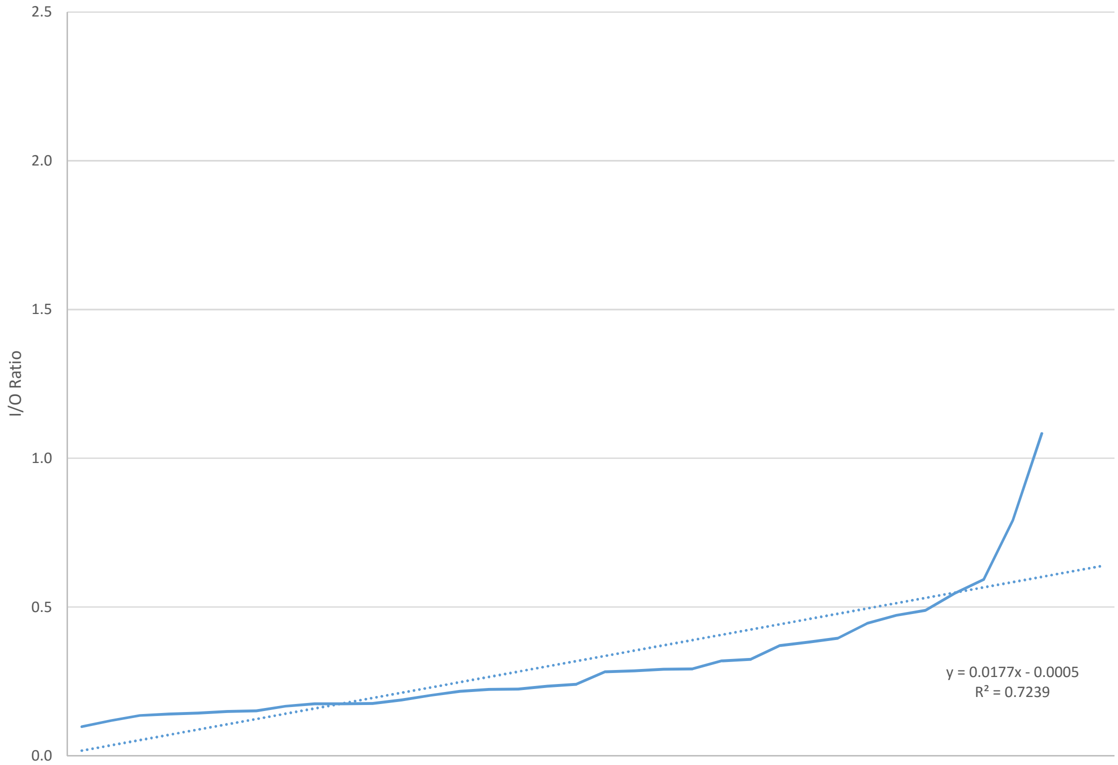

Figure H-16. PM_{10}, I/O ratio, Location A.

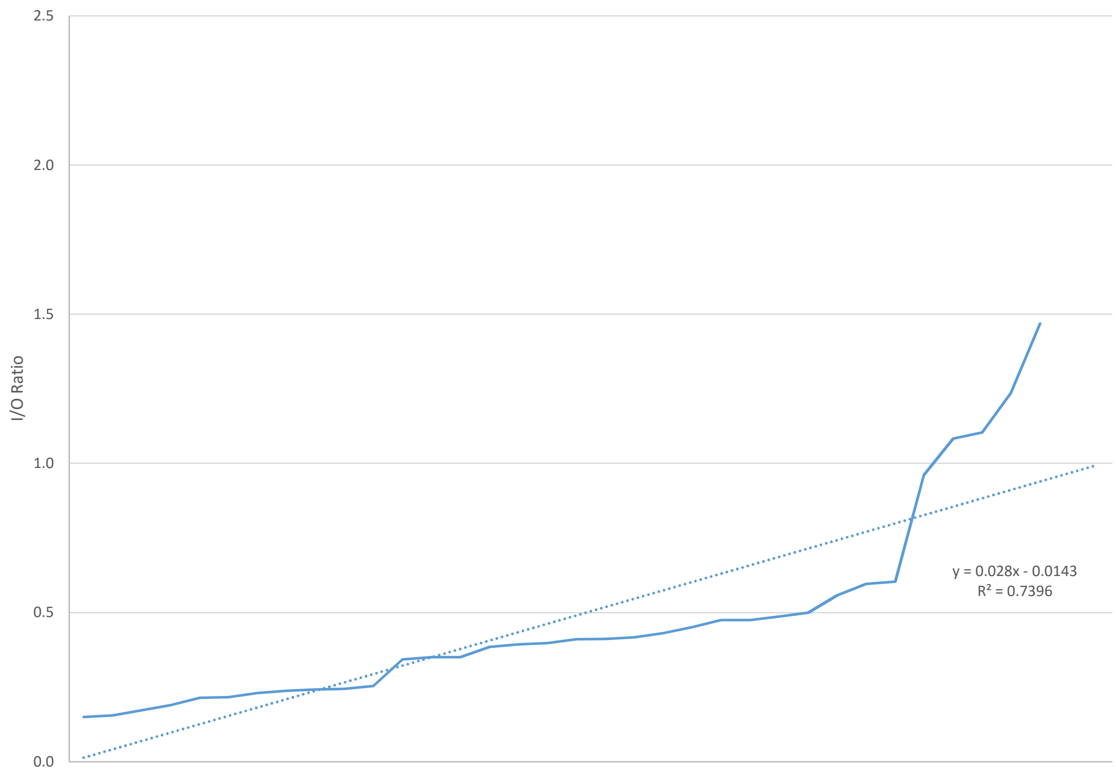

Figure H-17. PM_{10}, I/O ratio, Location B.

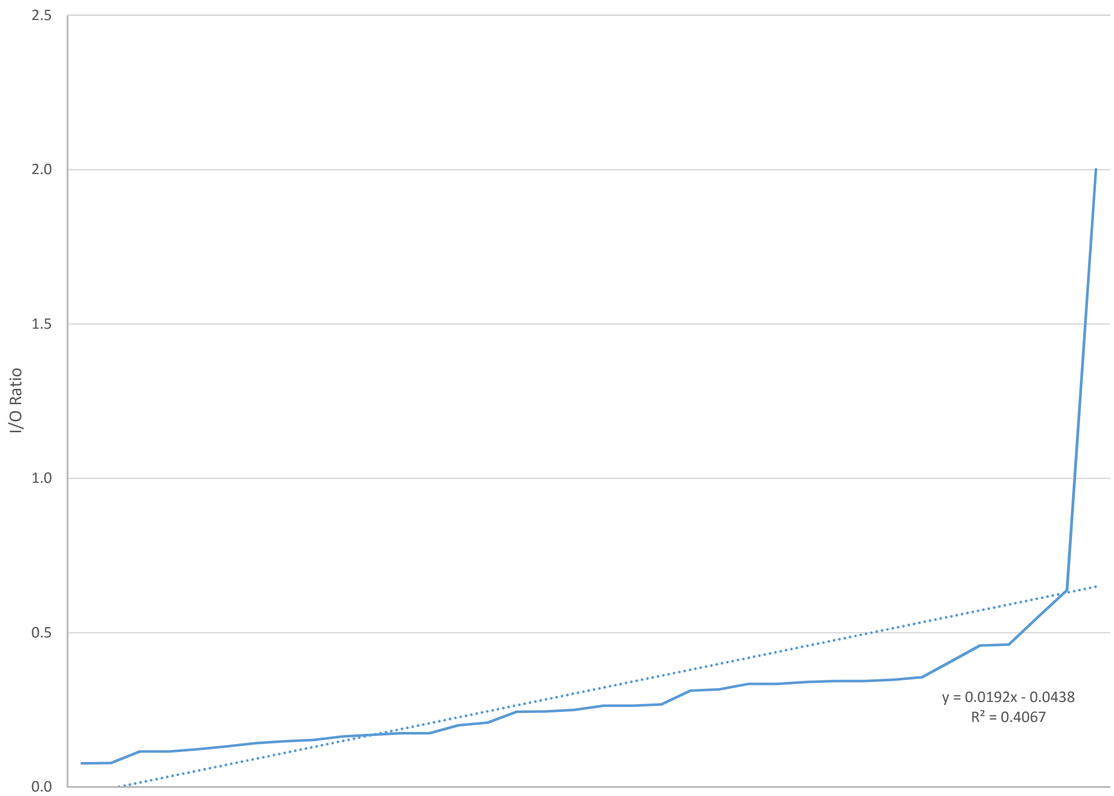

Figure H-18. PM_{10}, I/O ratio, Location C.

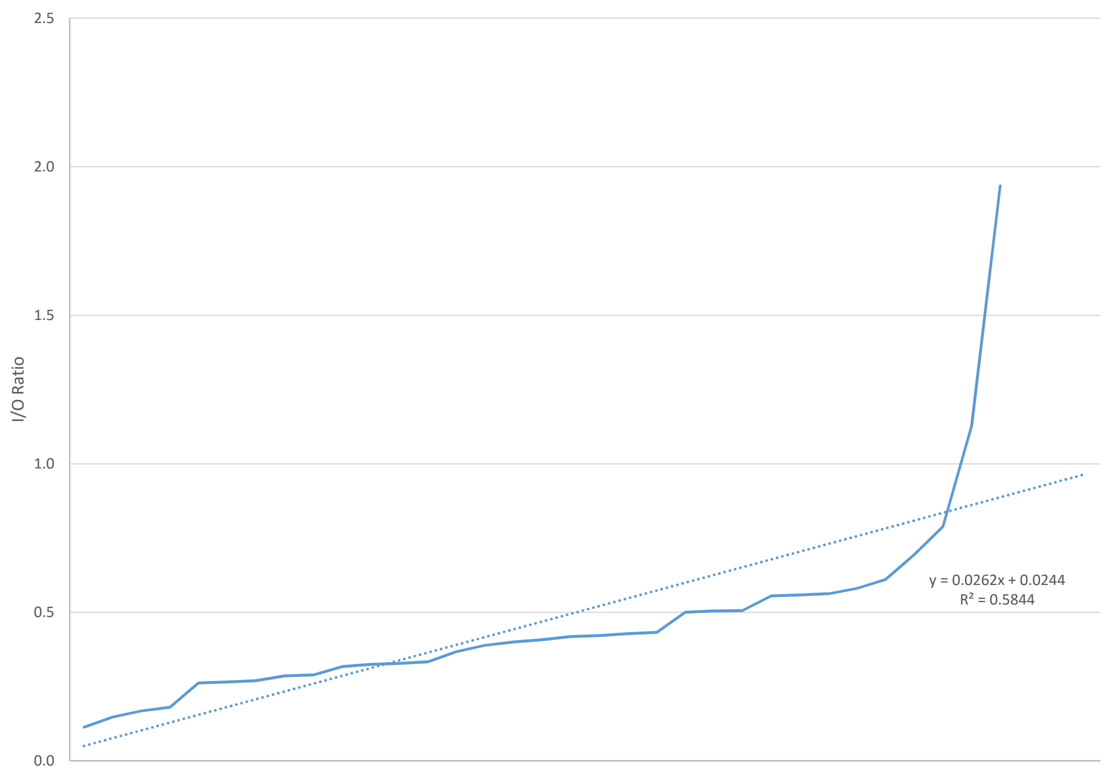

Figure H-19. PM_{10}, I/O ratio, Location D.

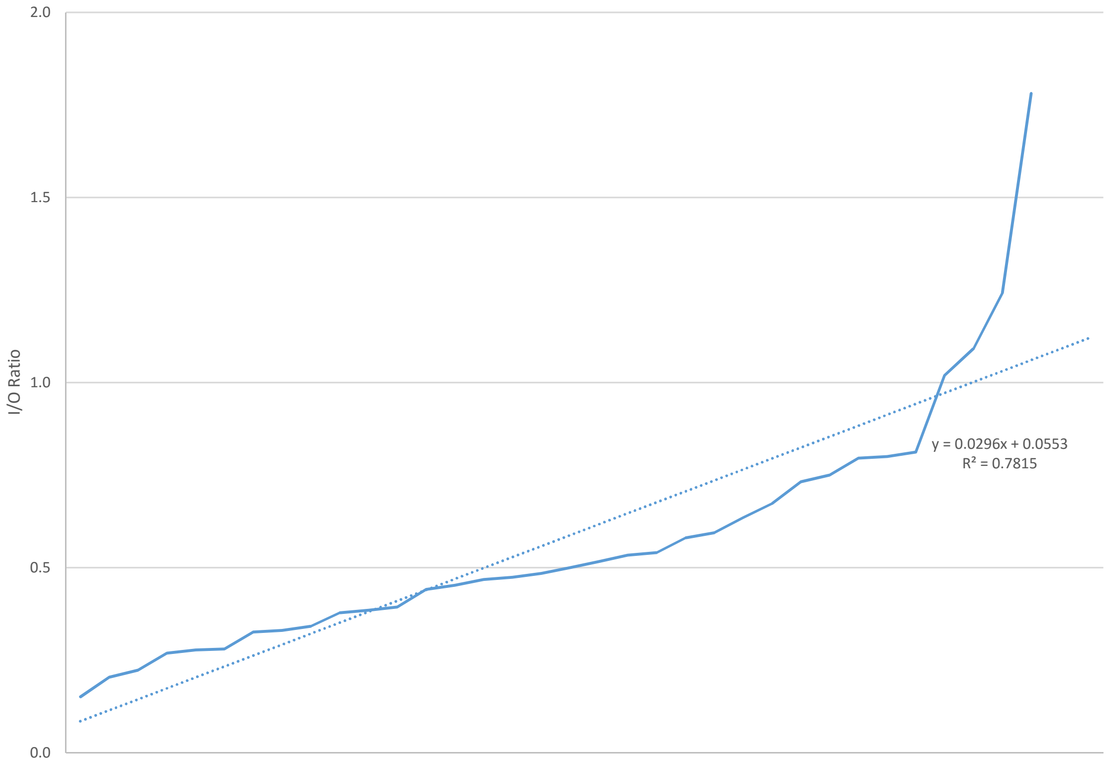

Figure H-20. PM_{10}, I/O ratio, Location E.

Appendix I – Graphs of NO_2

Graphs present NO_2 data per location and either indoor values, outdoor values, indoor versus outdoor values, or I/O ratio. Graphs of indoor and outdoor values include EPA limits for comparison. The primary limit averaged over one hour is 100 ppb (0.1 ppm). The primary and secondary limits averaged over one year are 53 ppb (0.053 ppm). Note that the data on these graphs have not been averaged according to the times suggested: they are presented only as point in time. EPA limits are only applicable to outdoor contaminant levels and have only been presented on indoor graphs for reference. The indoor and outdoor graphs have y-axes forced to 0.120 ppm. No limits were exceeded indoors at any location during this study. The primary limit averaged over one hour was exceeded in the outdoor samples at some point in time at Location A. The primary and secondary limits as averaged over one year were exceeded in the outdoor samples at some point in time at all locations. Graphs presenting data as indoor versus outdoor contaminant levels have forced y-axes of 0.050 ppm and x-axes of 0.120 ppm. Graphs presenting data as an I/O ratio have forced y-axes of 2.5.

Figure I-1. NO_2, Location A, indoor.

Figure I-2. NO_2, Location B, indoor.

Figure I-3. NO_2, Location C, indoor.

Figure I-4. NO_2, Location D, indoor.

Figure I-5. NO_2, Location E, indoor.

Figure I-6. NO_2, Location A, outdoor.

Figure I-7. NO_2, Location B, outdoor.

Figure I-8. NO_2, Location C, outdoor.

Figure I-9. NO_2, Location D, outdoor.

Figure I-10. NO_2, Location E, outdoor.

Figure I-11. NO_2, indoor vs outdoor contaminant levels, Location A.

Figure I-12. NO_2, indoor vs outdoor contaminant levels, Location B.

Figure I-13. NO_2, indoor vs outdoor contaminant levels, Location C.

Figure I-14. NO_2, indoor vs outdoor contaminant levels, Location D.

Figure I-15. NO_2, indoor vs outdoor contaminant levels, Location E.

Figure I-16. NO_2, I/O ratio, Location A.

Figure I-17. NO_2, I/O ratio, Location B.

Figure I-18. NO_2, I/O ratio, Location C.

Figure I-19. NO_2, I/O ratio, Location D.

Figure I-20. NO_2, I/O ratio, Location E.

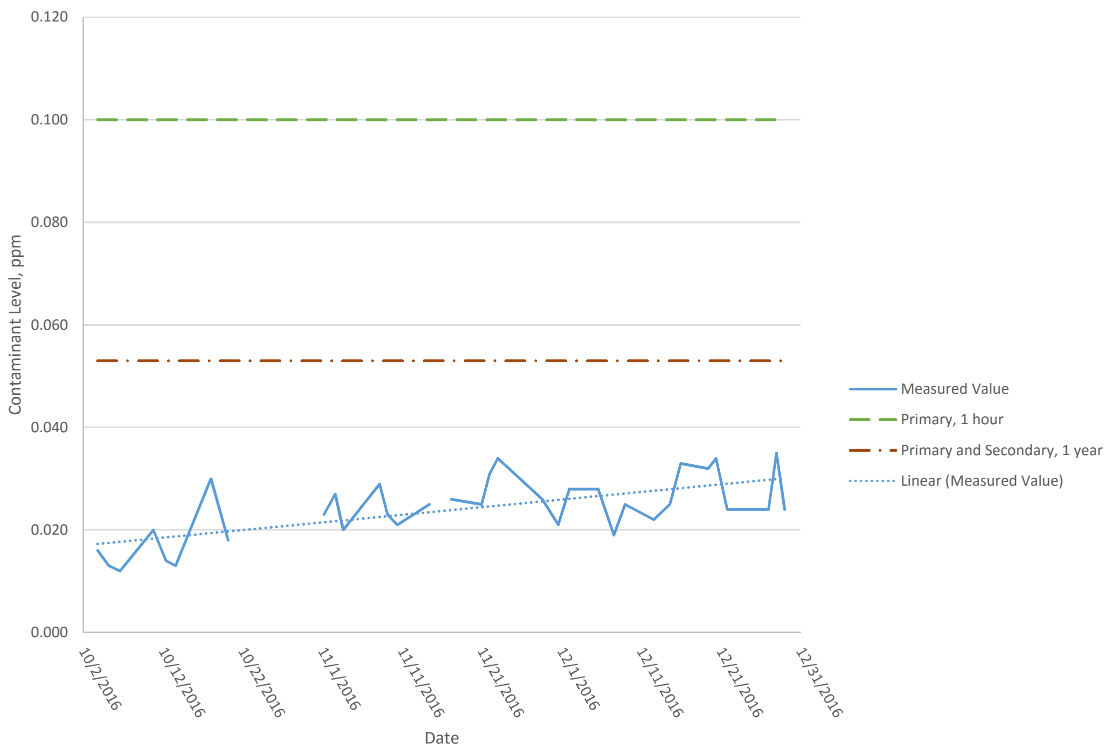

Figure I-1. NO_2, Location A, indoor.

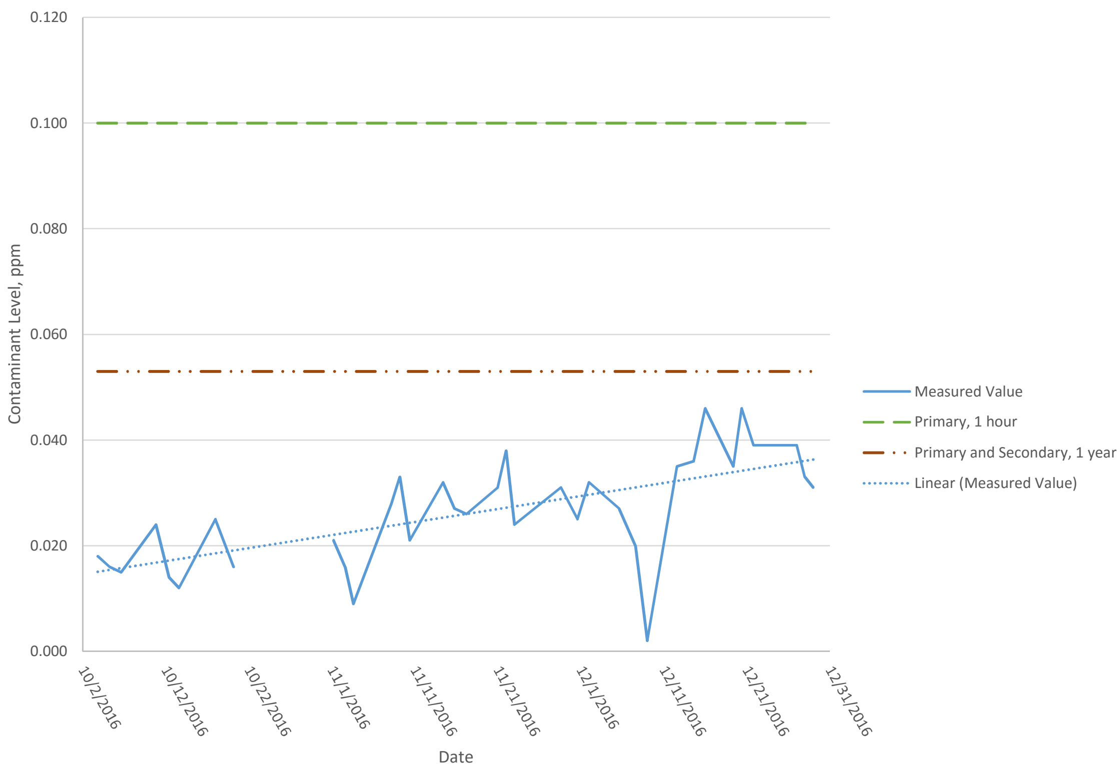

Figure I-2. NO_2, Location B, indoor.

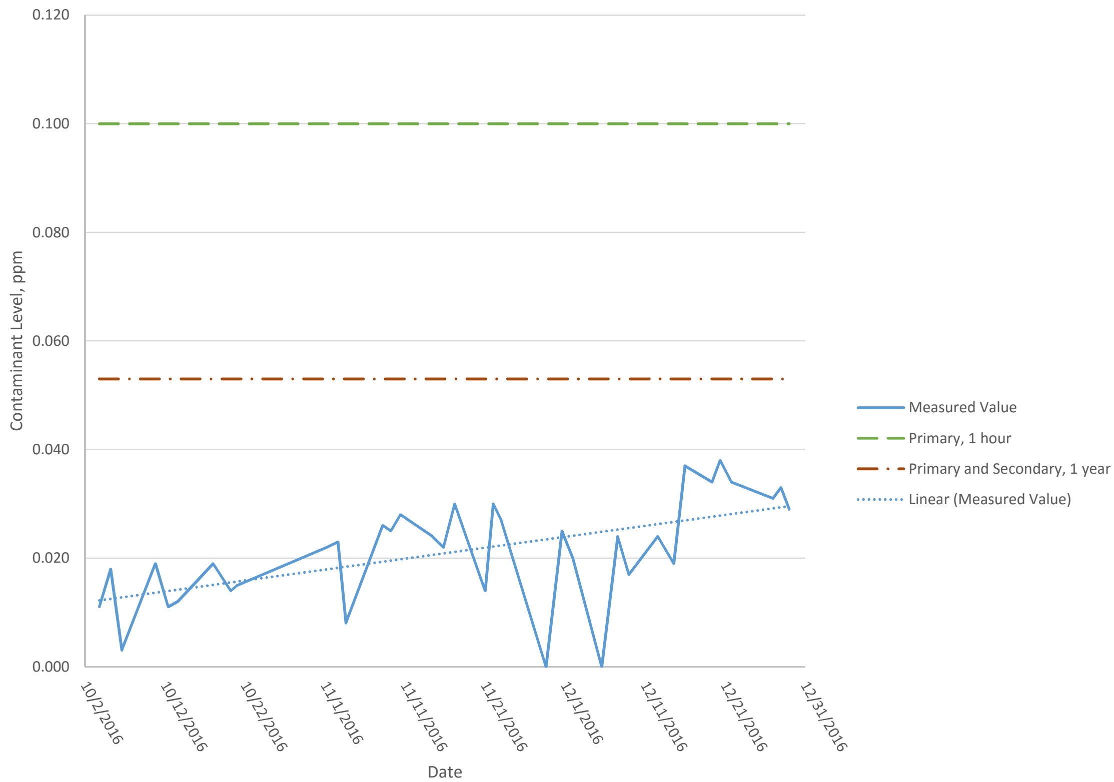

Figure I-3. NO_2, Location C, indoor.

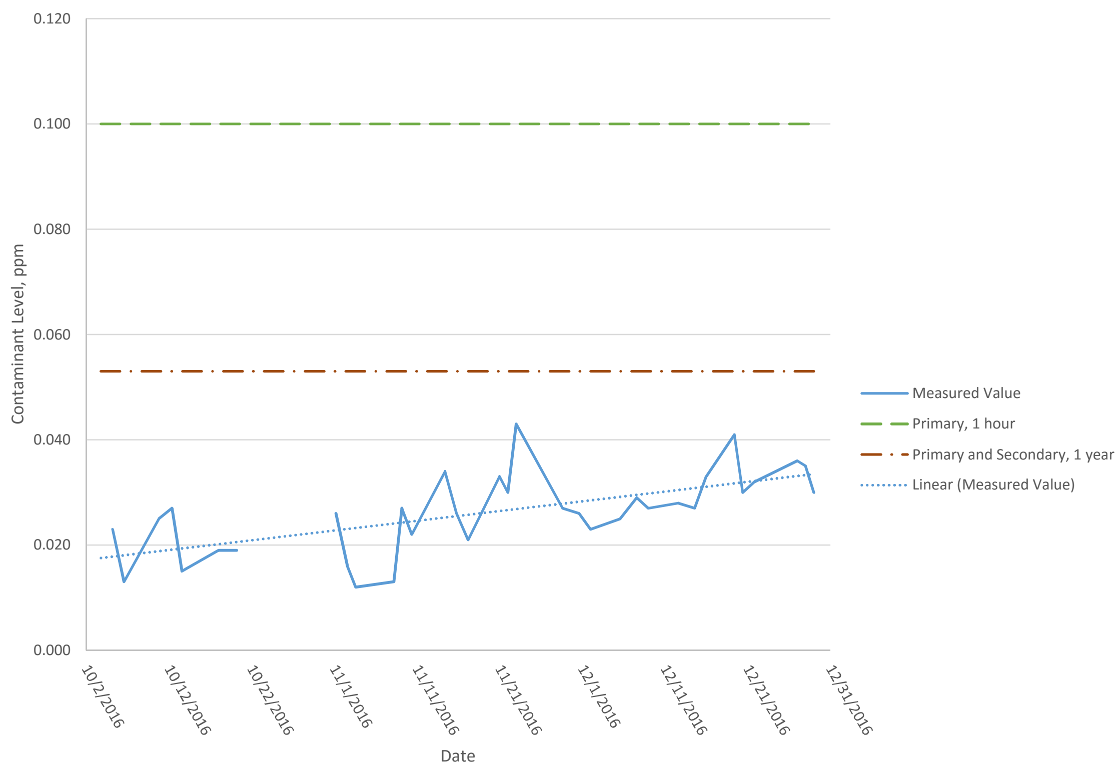

Figure I-4. NO_2, Location D, indoor.

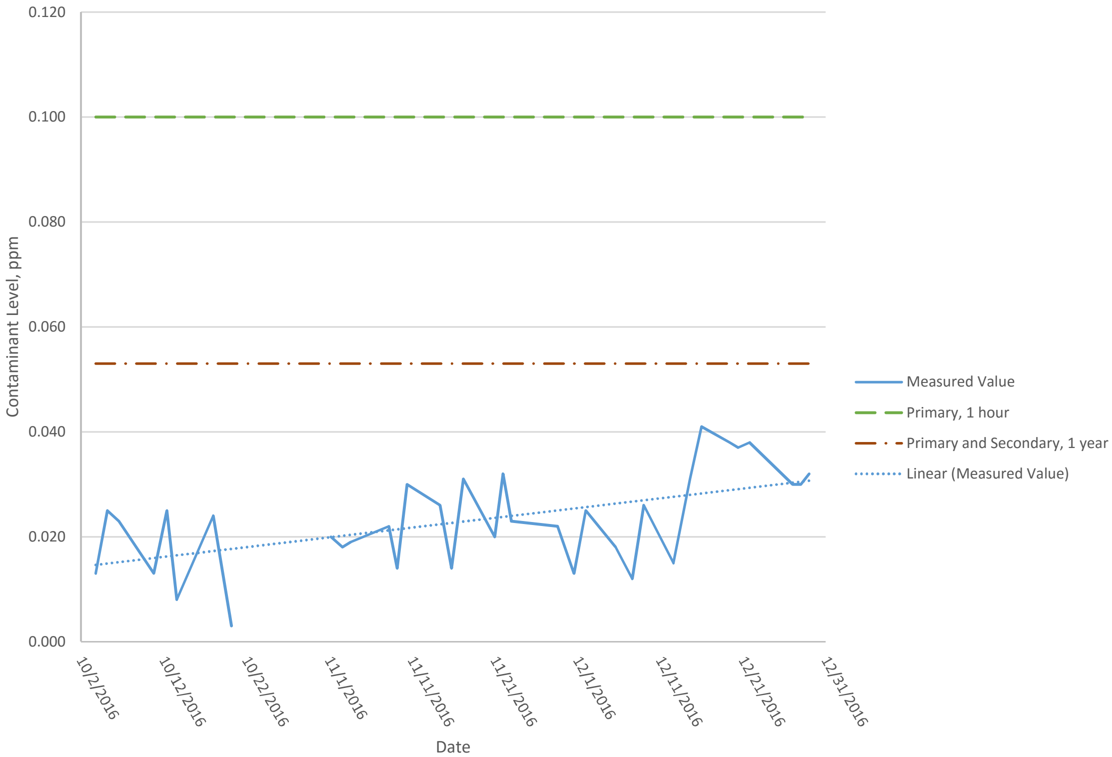

Figure I-5. NO_2, Location E, indoor.

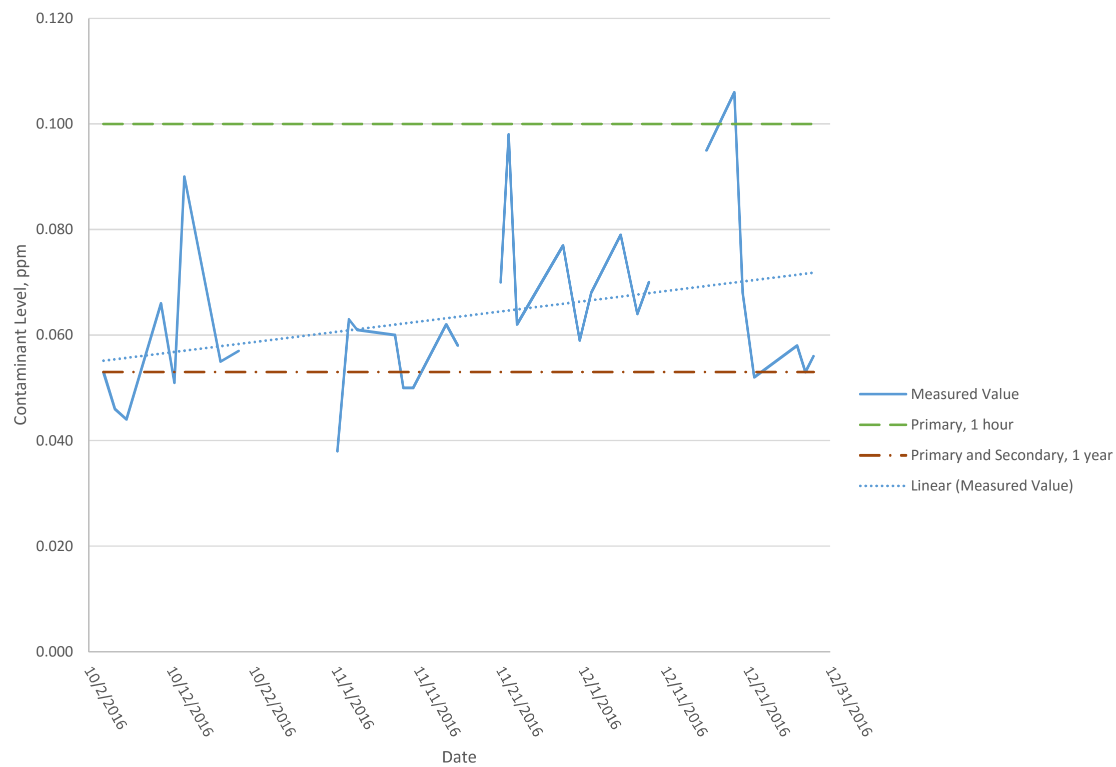

Figure I-6. NO_2, Location A, outdoor.

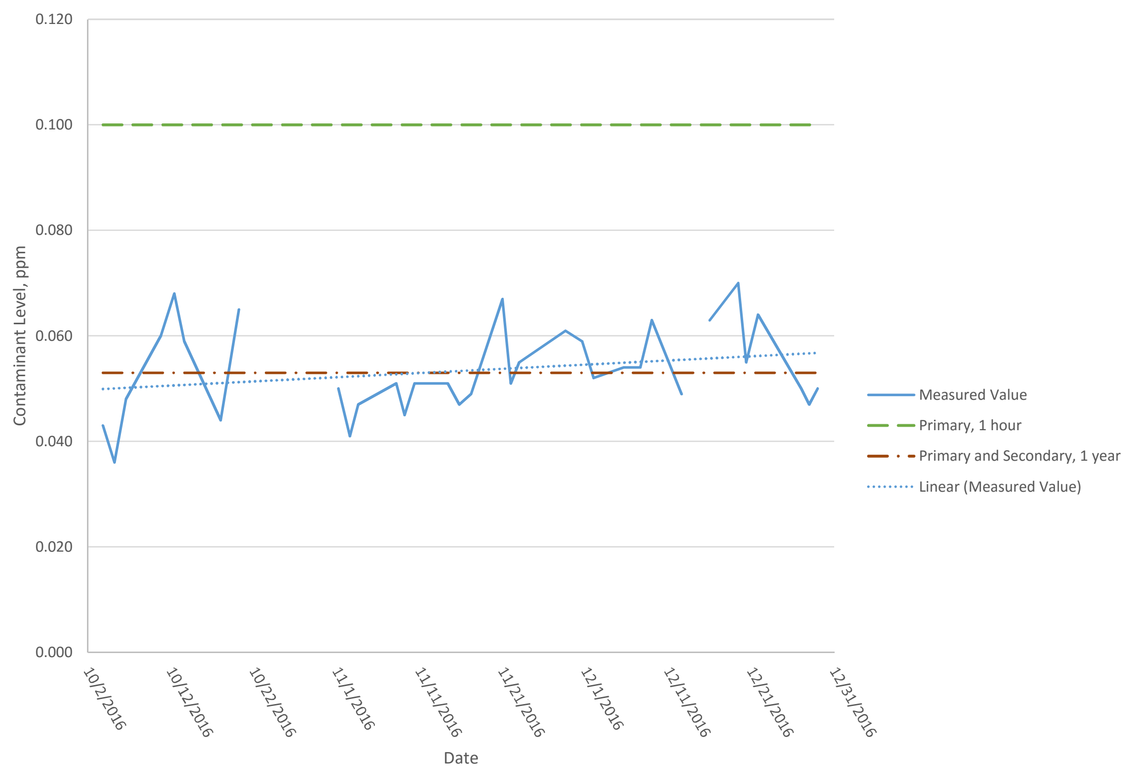

Figure I-7. NO_2, Location B, outdoor.

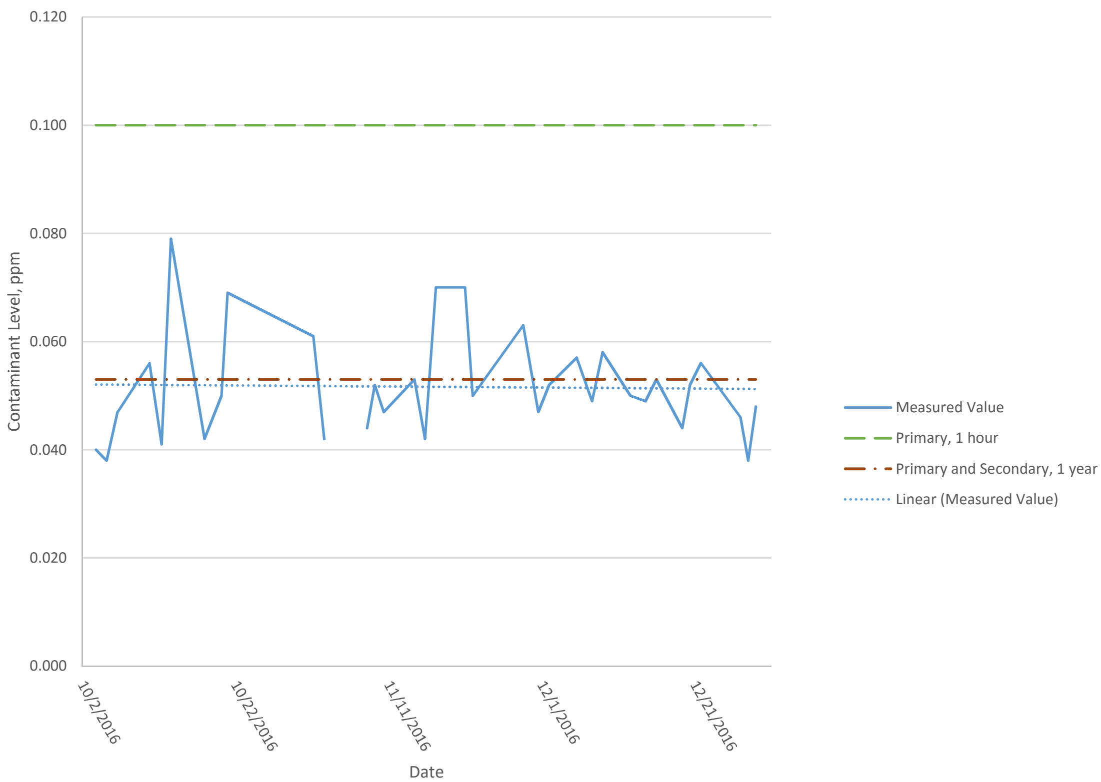

Figure I-8. NO_2, Location C, outdoor.

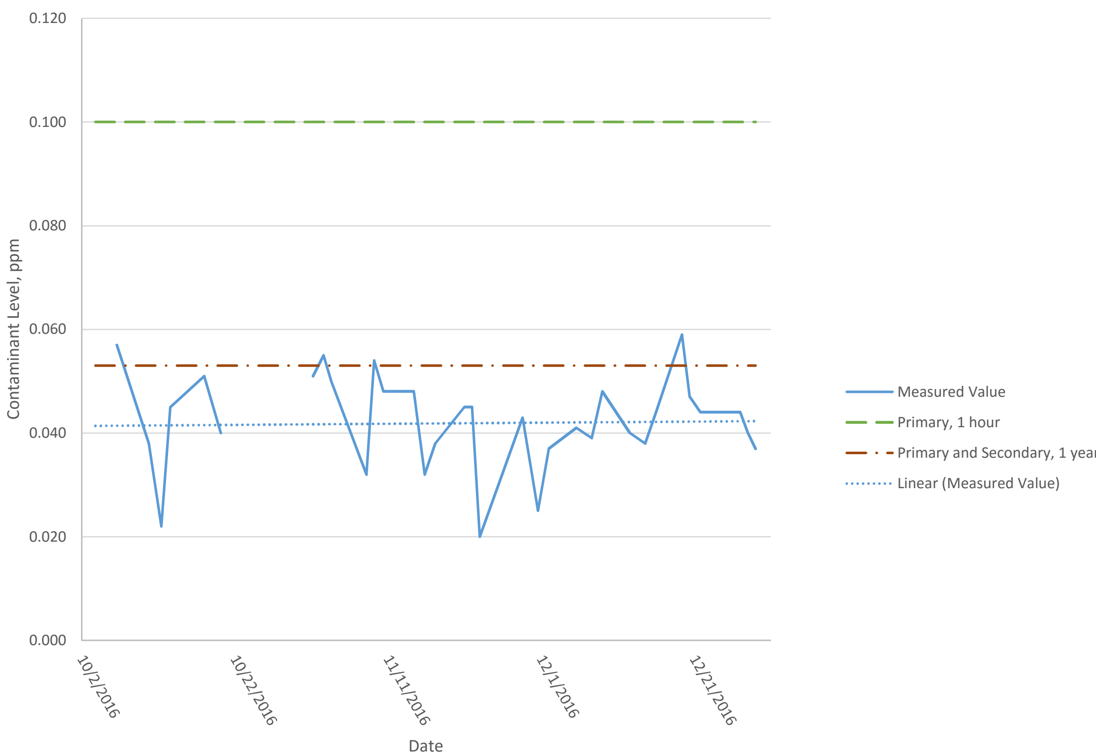

Figure I-9. NO_2, Location D, outdoor.

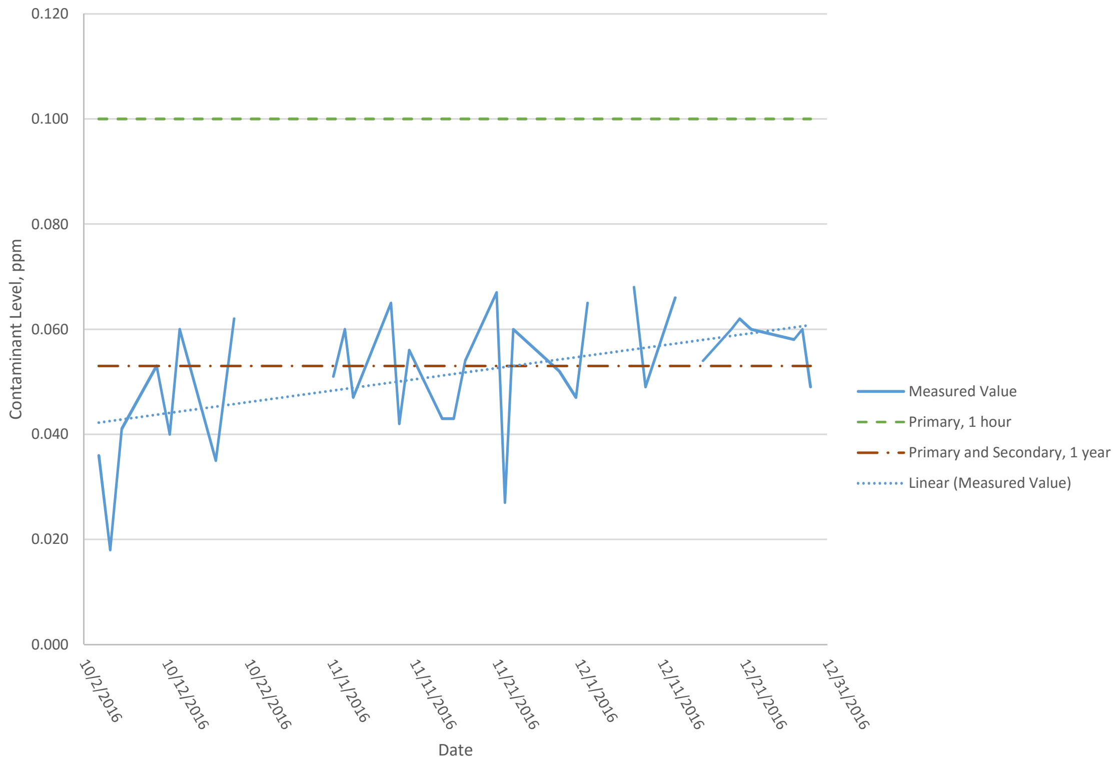

Figure I-10. NO_2, Location E, outdoor.

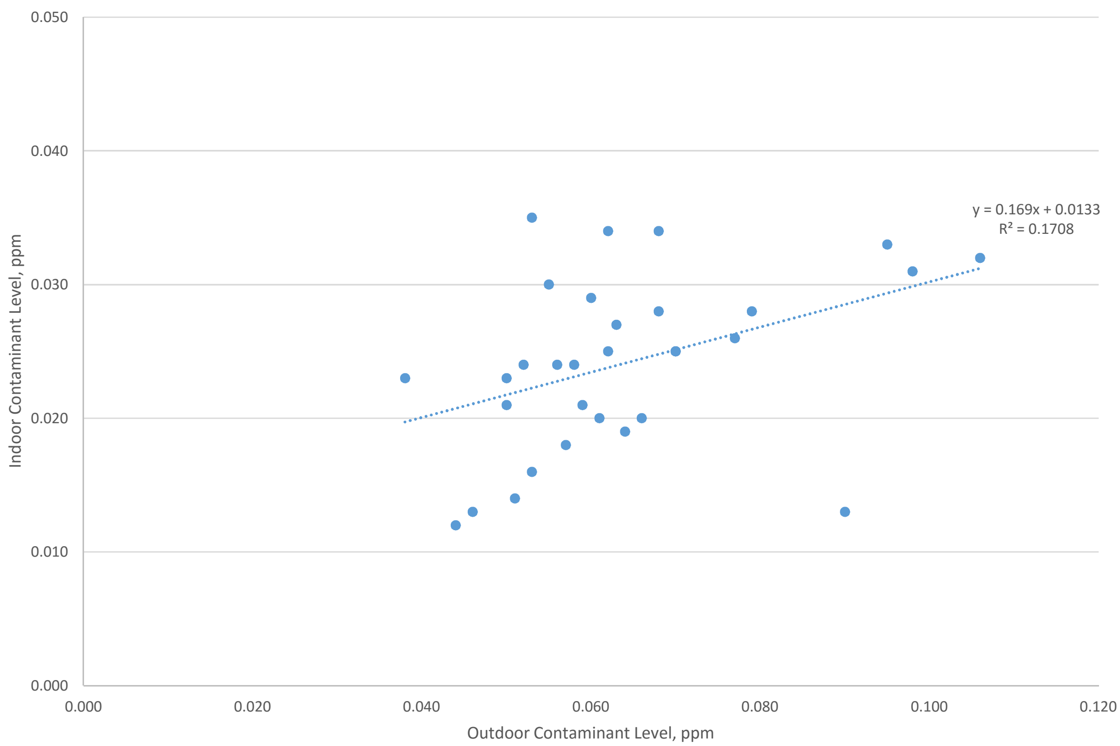

Figure I-11. NO_2, indoor vs outdoor contaminant levels, Location A.

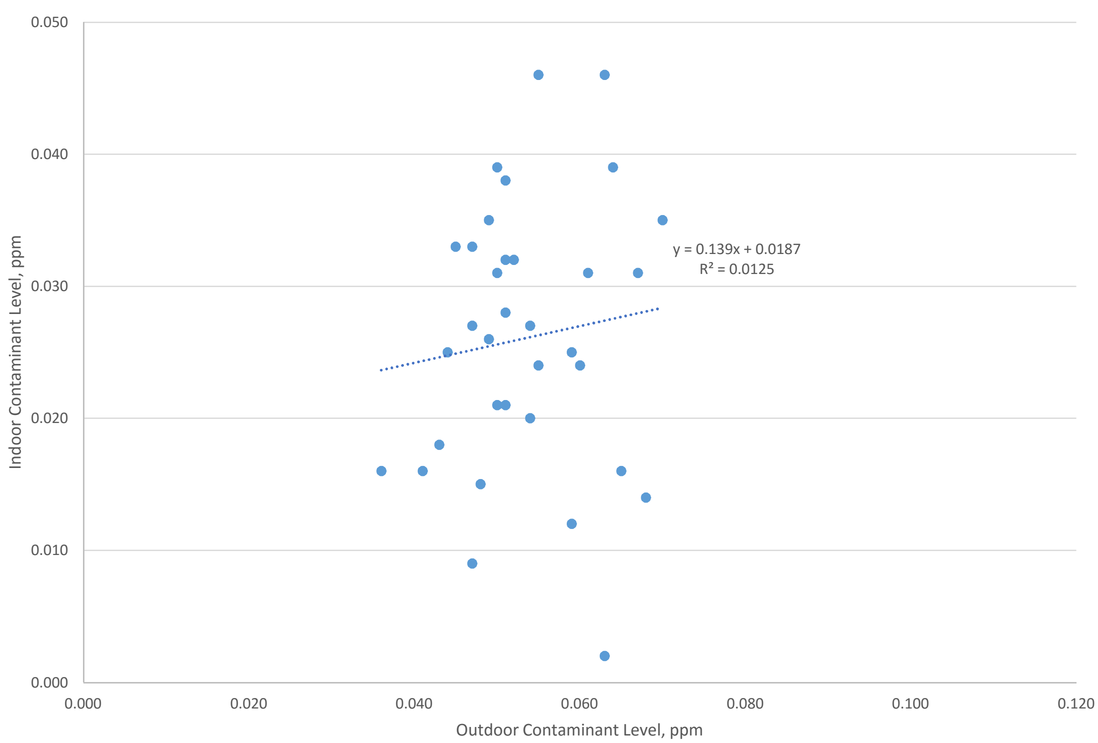

Figure I-12. NO_2, indoor vs outdoor contaminant levels, Location B.

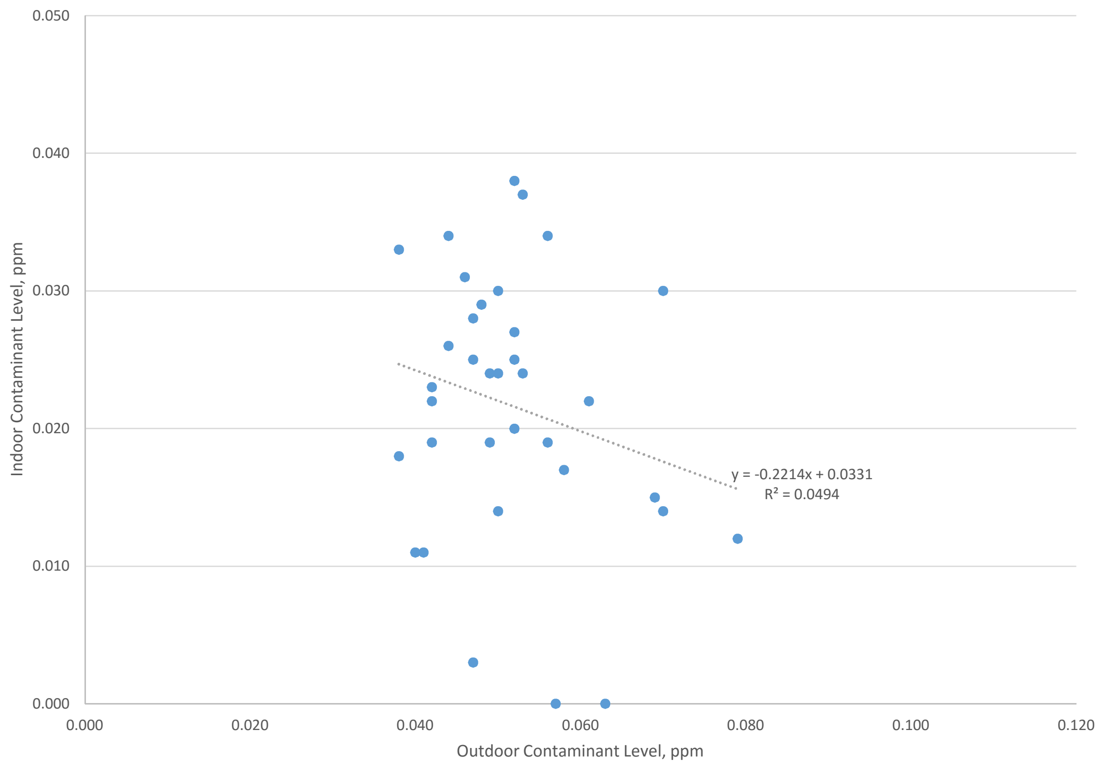

Figure I-13. NO_2, indoor vs outdoor contaminant levels, Location C.

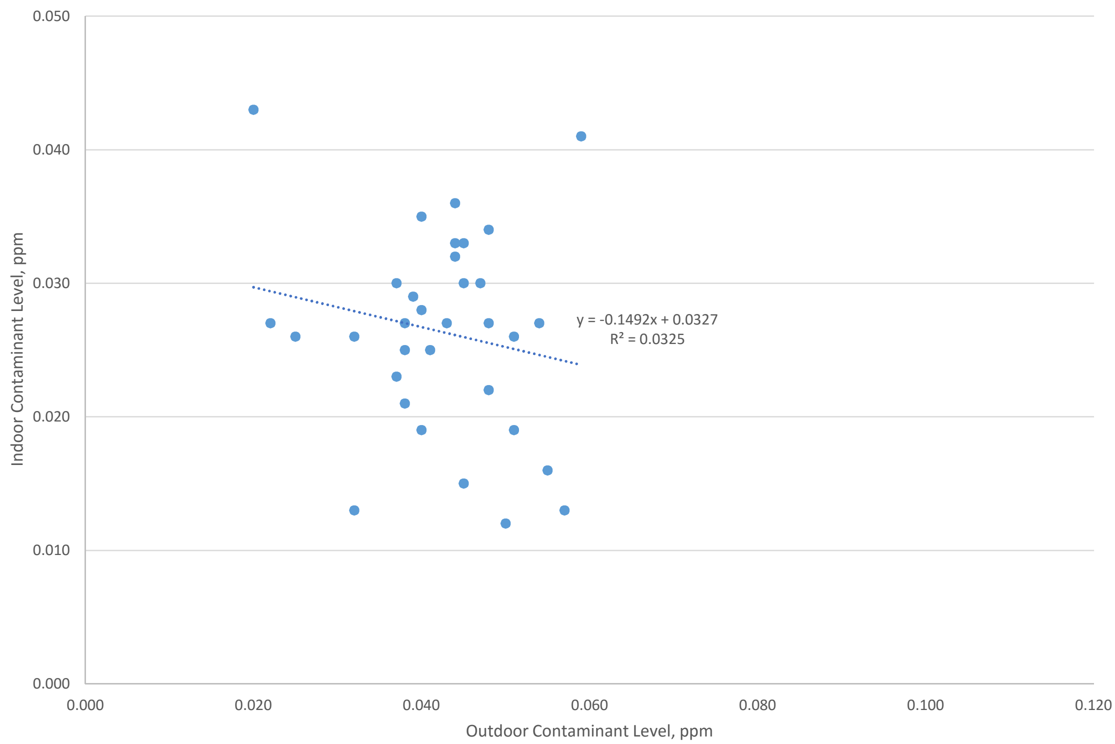

Figure I-14. NO_2, indoor vs outdoor contaminant levels, Location D.

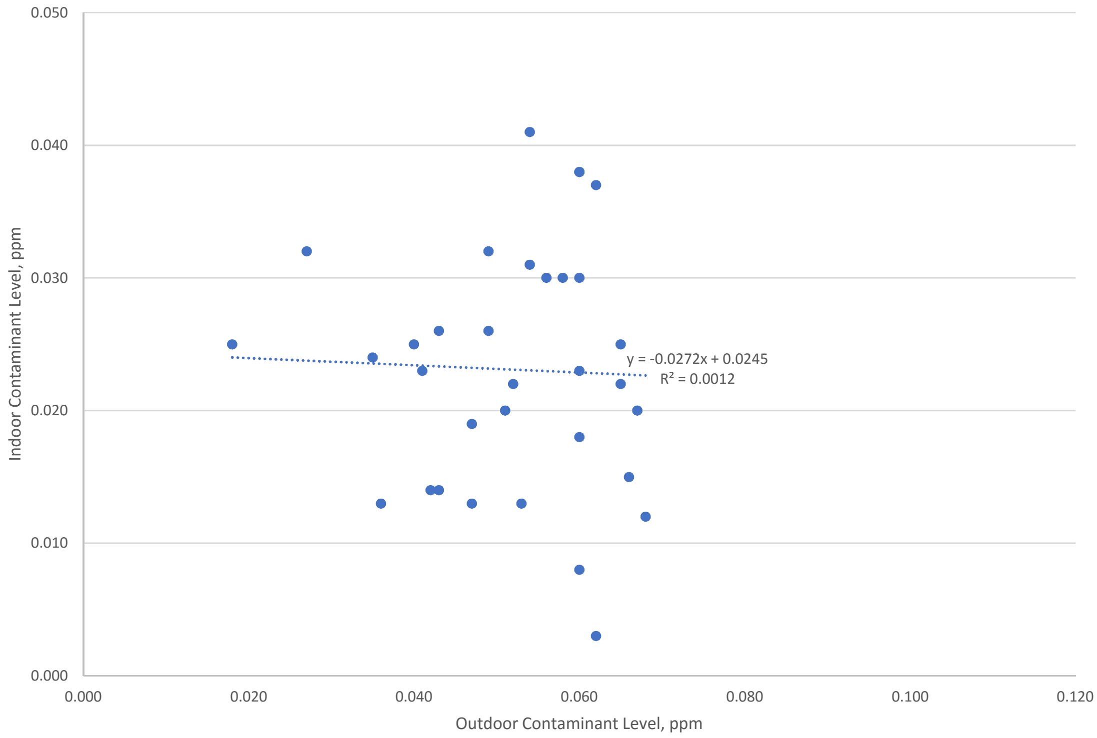

Figure I-15. NO_2, indoor vs outdoor contaminant levels, Location E.

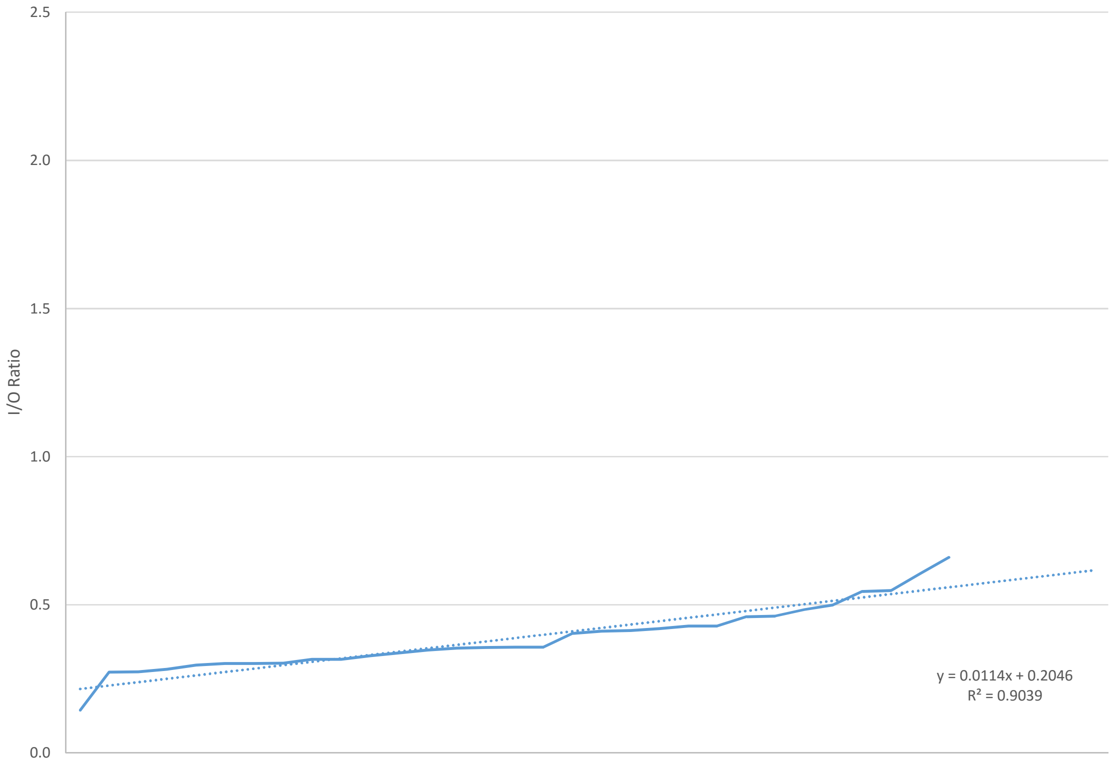

Figure I-16. NO_2, I/O ratio, Location A.

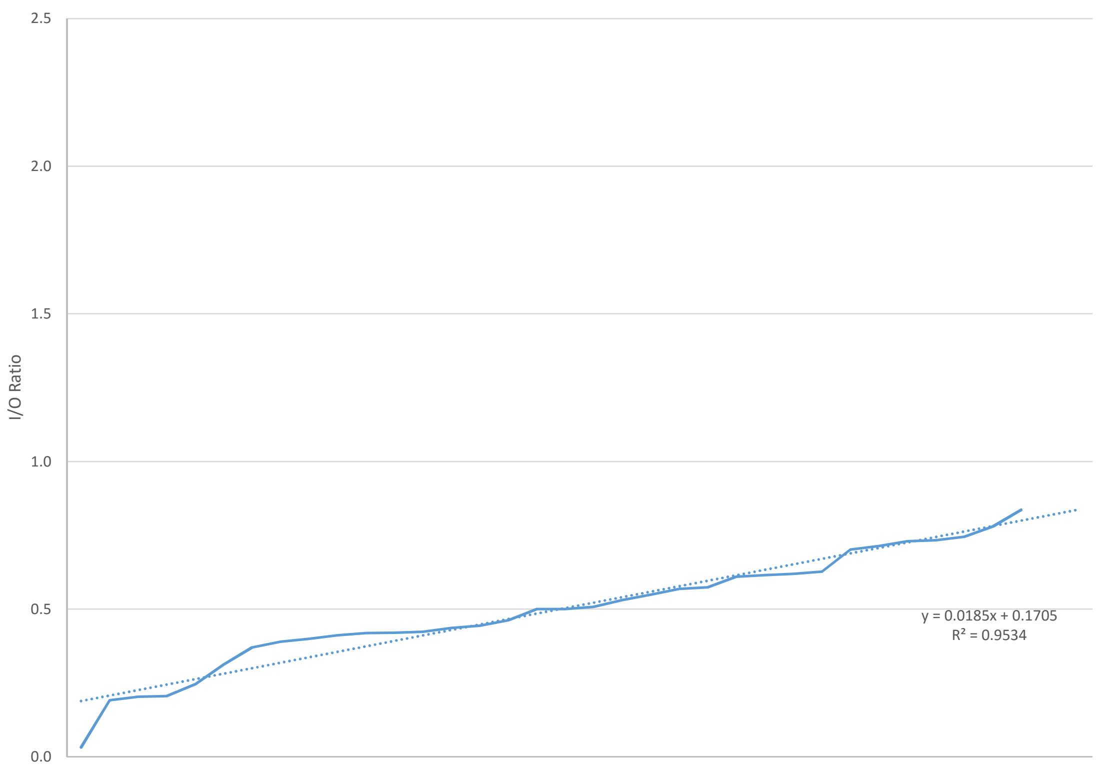

Figure I-17. NO_2, I/O ratio, Location B.

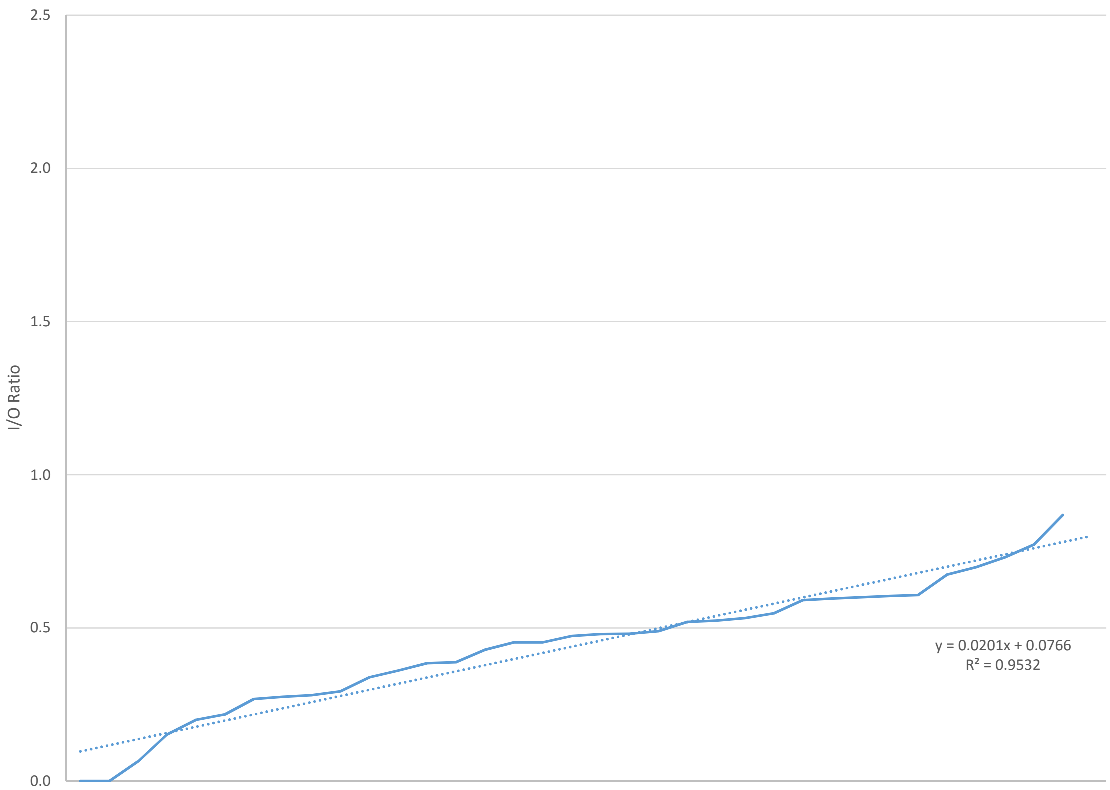

Figure I-18. NO_2, I/O ratio, Location C.

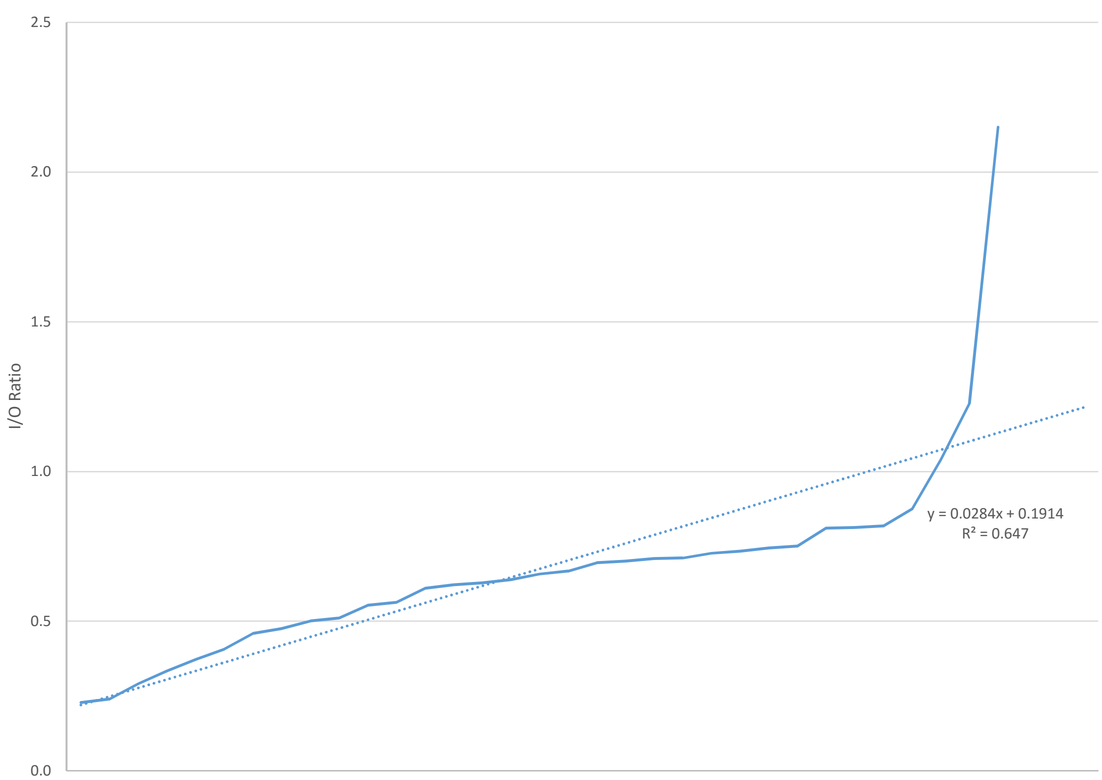

Figure I-19. NO_2, I/O ratio, Location D.

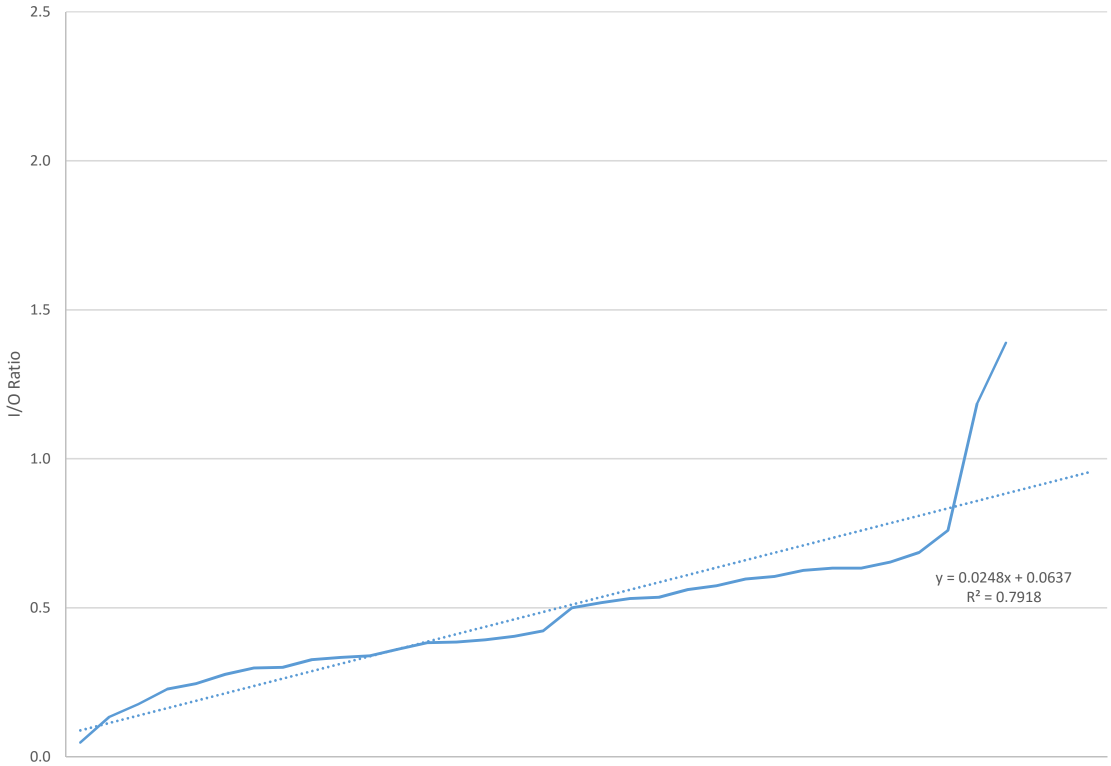

Figure I-20. NO_2, I/O ratio, Location E.

Appendix J – Graphs of SO_2

Graphs present SO_2 data per location and either indoor values or outdoor values. Graphs include EPA limits for comparison. The primary limit averaged over 1 hour is 75 ppb (0.075 ppm). The secondary limit averaged over 3 hours is 0.5 ppm. Note that the data on these graphs have not been averaged according to the time suggested: they are presented only as points in time. EPA limits are only applicable to outdoor contaminant levels and have only been presented on indoor graphs for reference. The indoor and outdoor graphs have y-axes forced from 0.00 to 0.60 ppm. Primary limits averaged over 1 hour were exceeded in the indoor samples at some point in time at Locations A and B. No limits were exceeded outdoors at any location during this study. Graphs presenting data as indoor versus outdoor contaminant levels or as I/O ratios have not been included as nearly all outdoor values were measured as 0.00 ppm.

Figure J-1. SO_2, Location A, indoor.

Figure J-2. SO_2, Location B, indoor.

Figure J-3. SO_2, Location C, indoor.

Figure J-4. SO_2, Location D, indoor.

Figure J-5. SO_2, Location E, indoor.

Figure J-6. SO_2, Location A, outdoor.

Figure J-7. SO_2, Location B, outdoor.

Figure J-8. SO_2, Location C, outdoor.

Figure J-9. SO_2, Location D, outdoor.

Figure J-10. SO_2, Location E, outdoor.

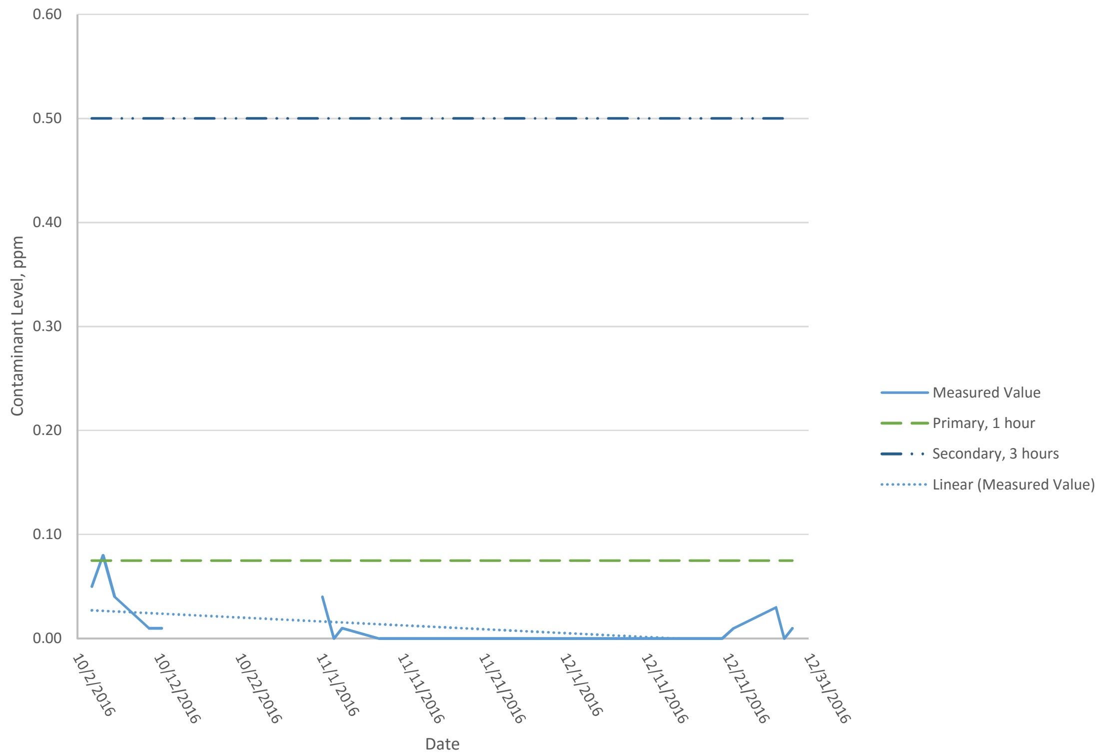

Figure J-1. SO_2, Location A, indoor.

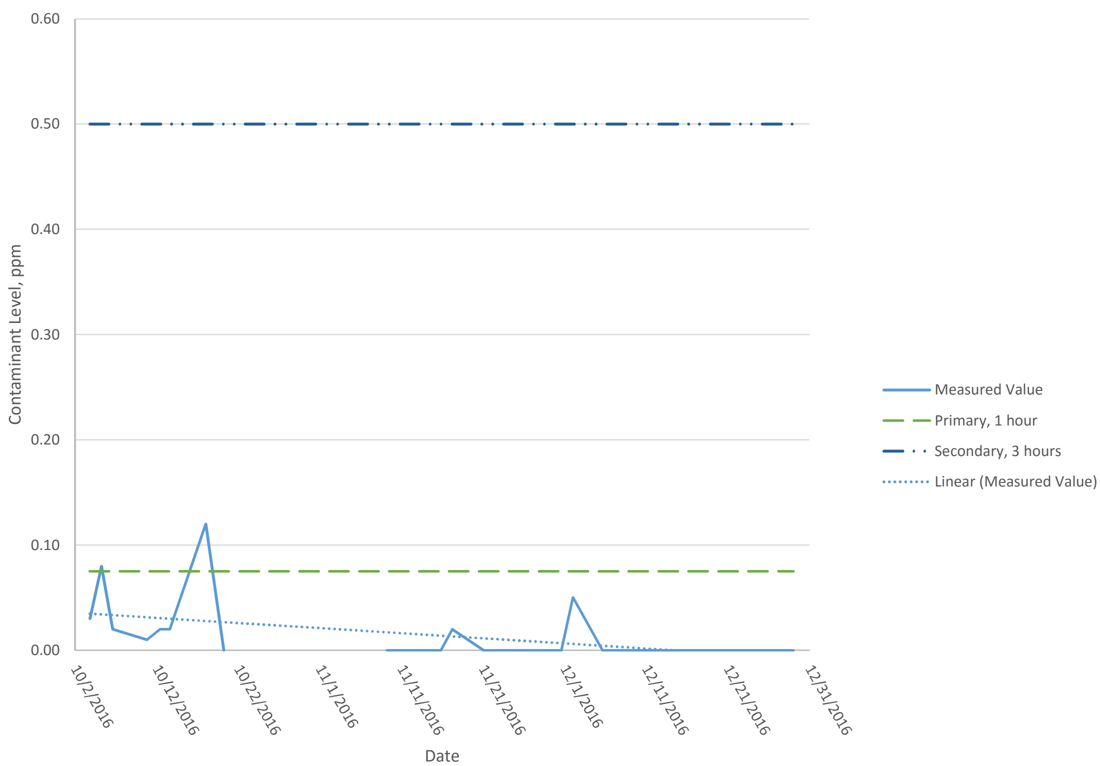

Figure J-2. SO_2, Location B, indoor.

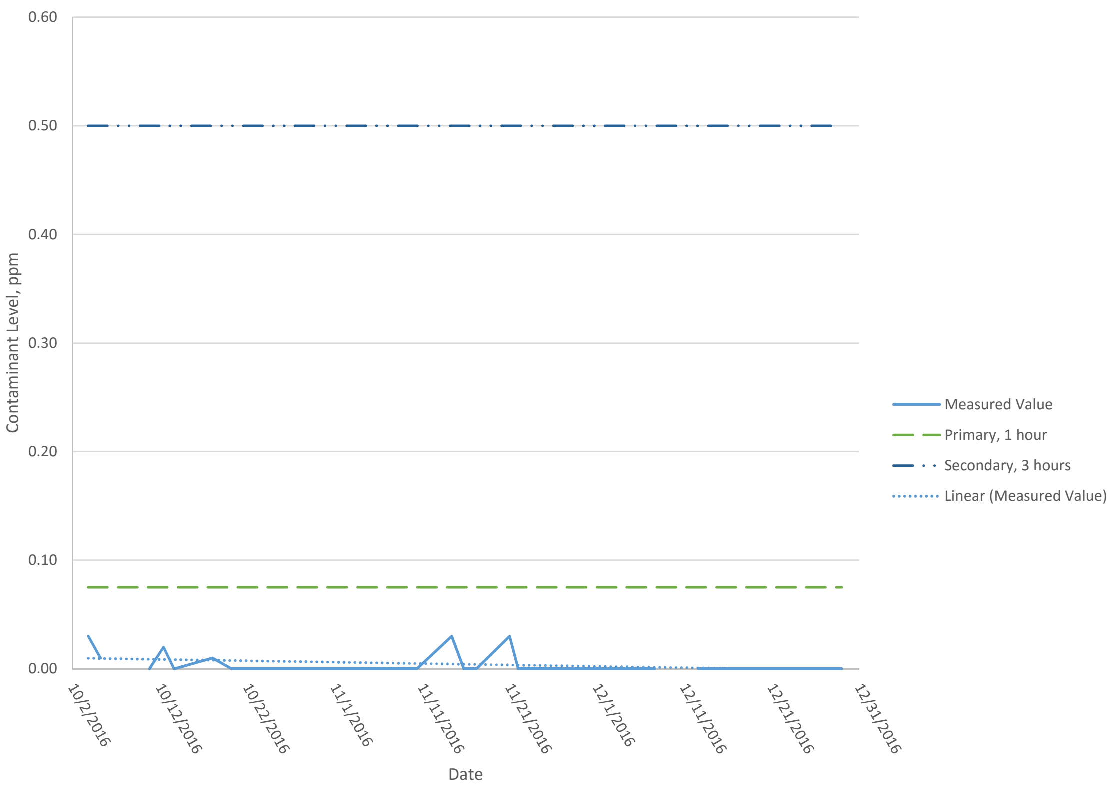

Figure J-3. SO_2, Location C, indoor.

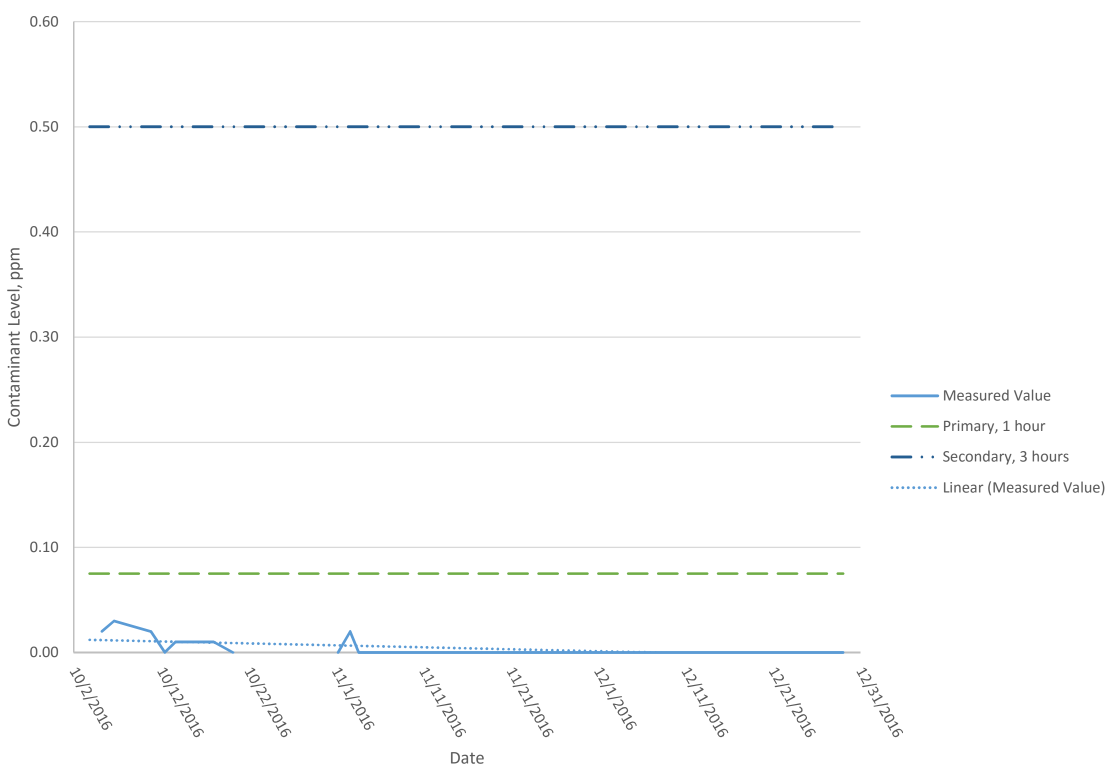

Figure J-4. SO_2, Location D, indoor.

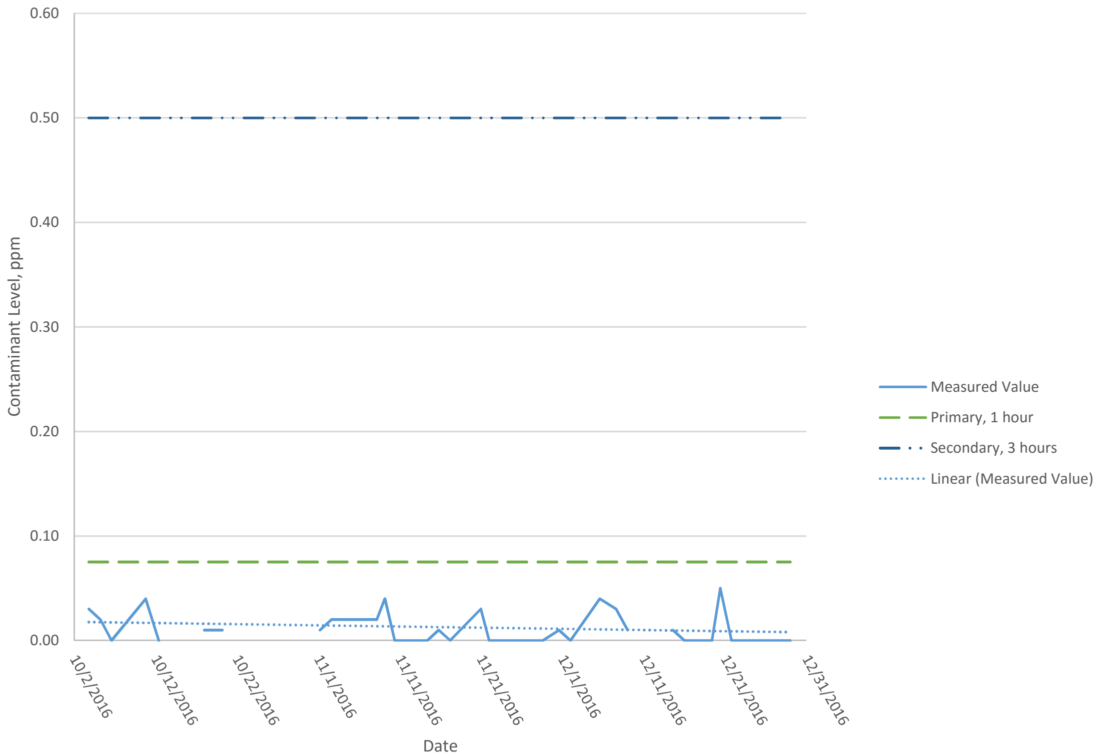

Figure J-5. SO_2, Location E, indoor.

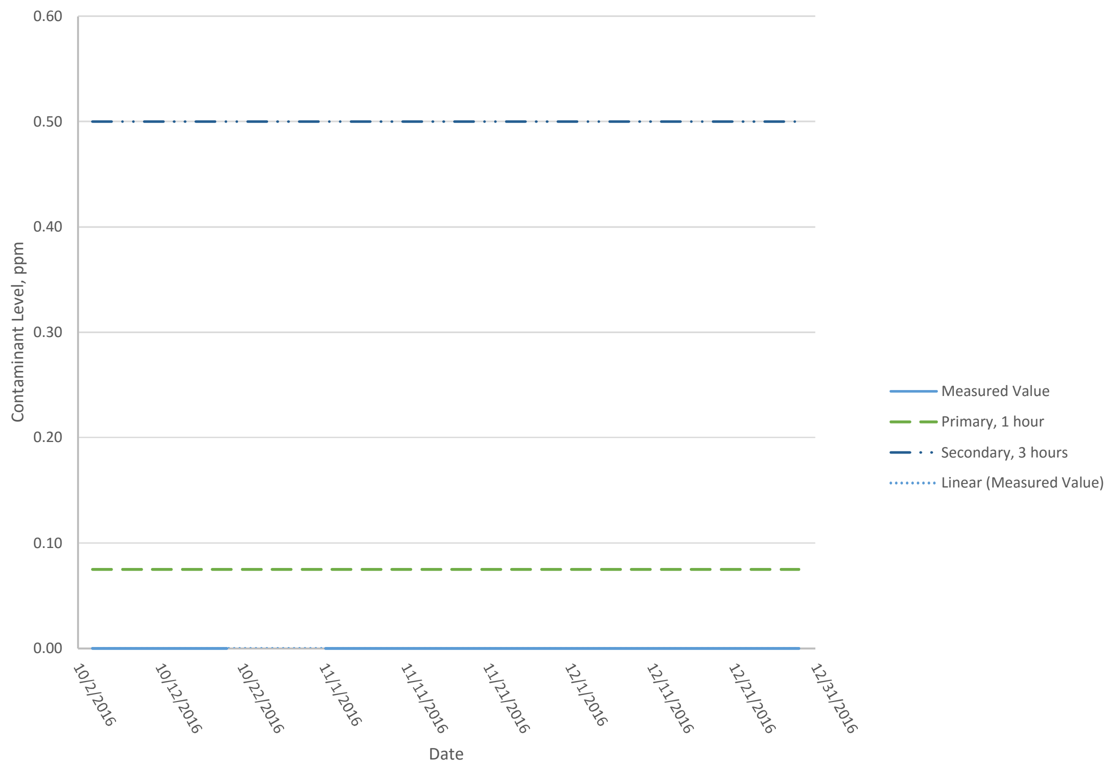

Figure J-6. SO_2, Location A, outdoor.

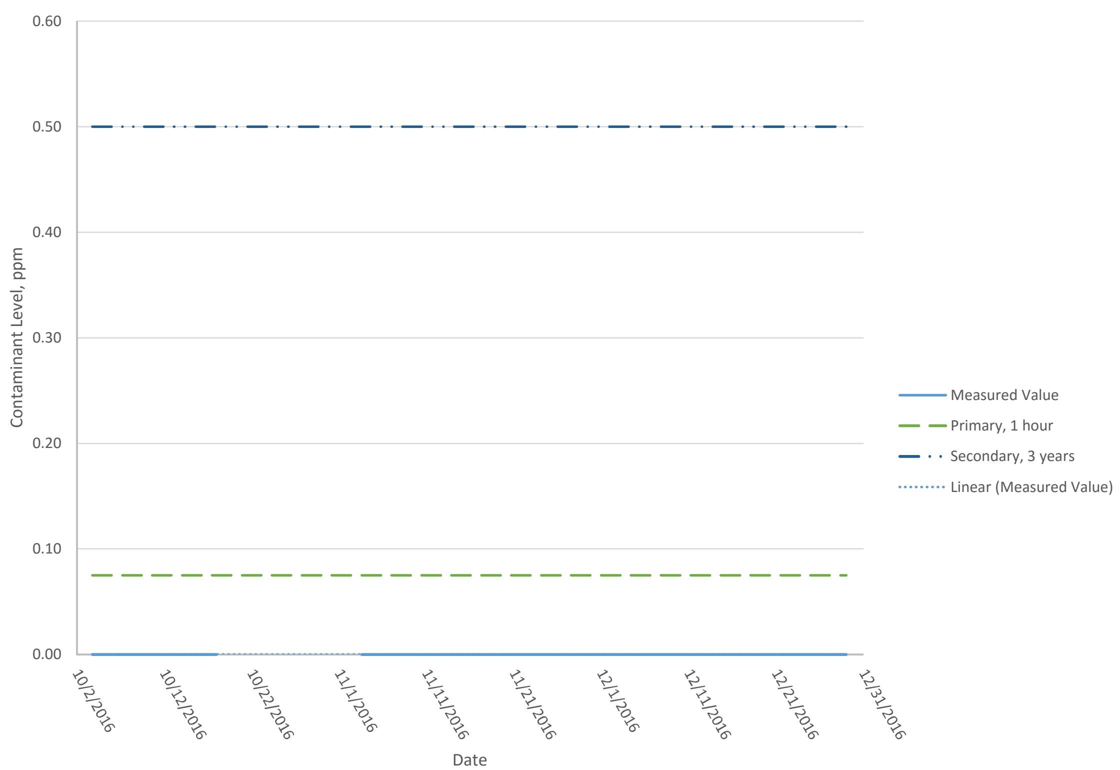

Figure J-7. SO_2, Location B, outdoor.

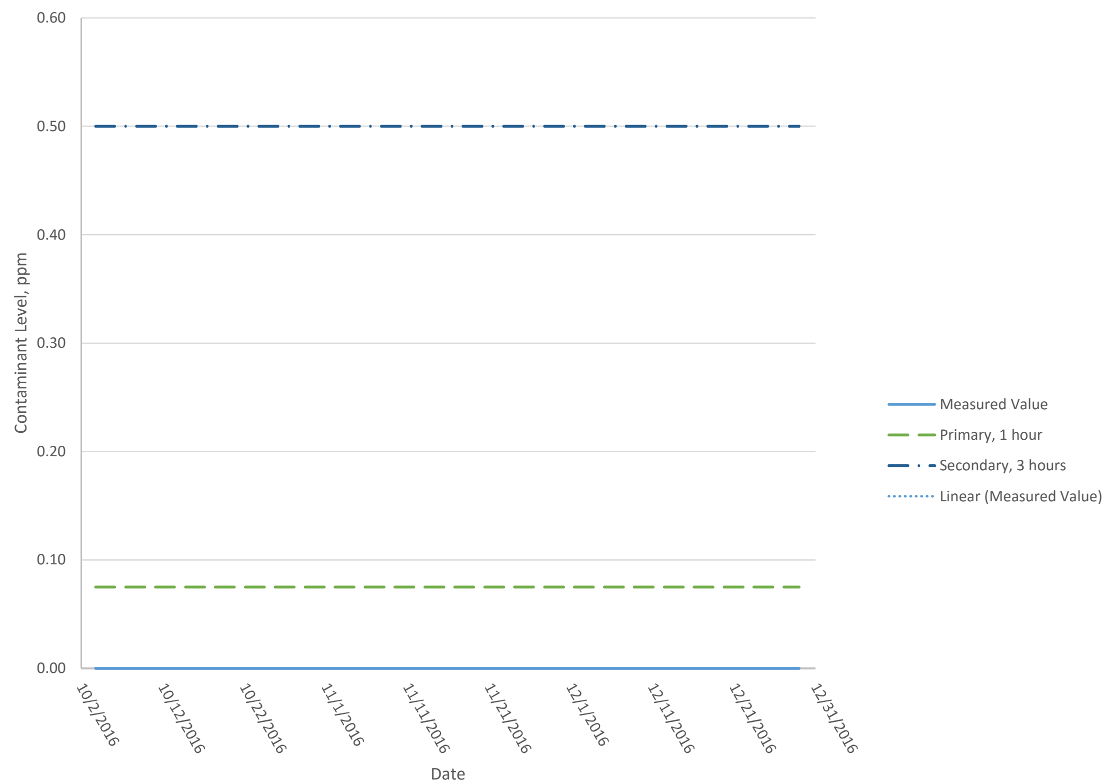

Figure J-8. SO_2, Location C, outdoor.

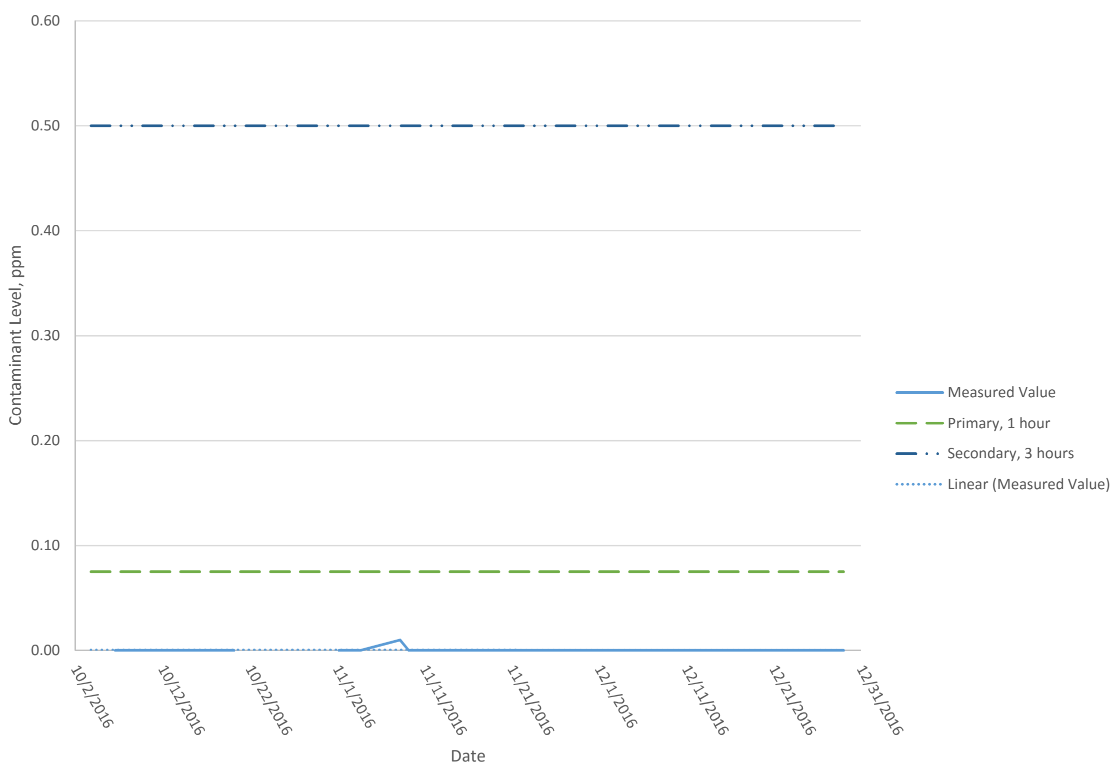

Figure J-9. SO_2, Location D, outdoor.

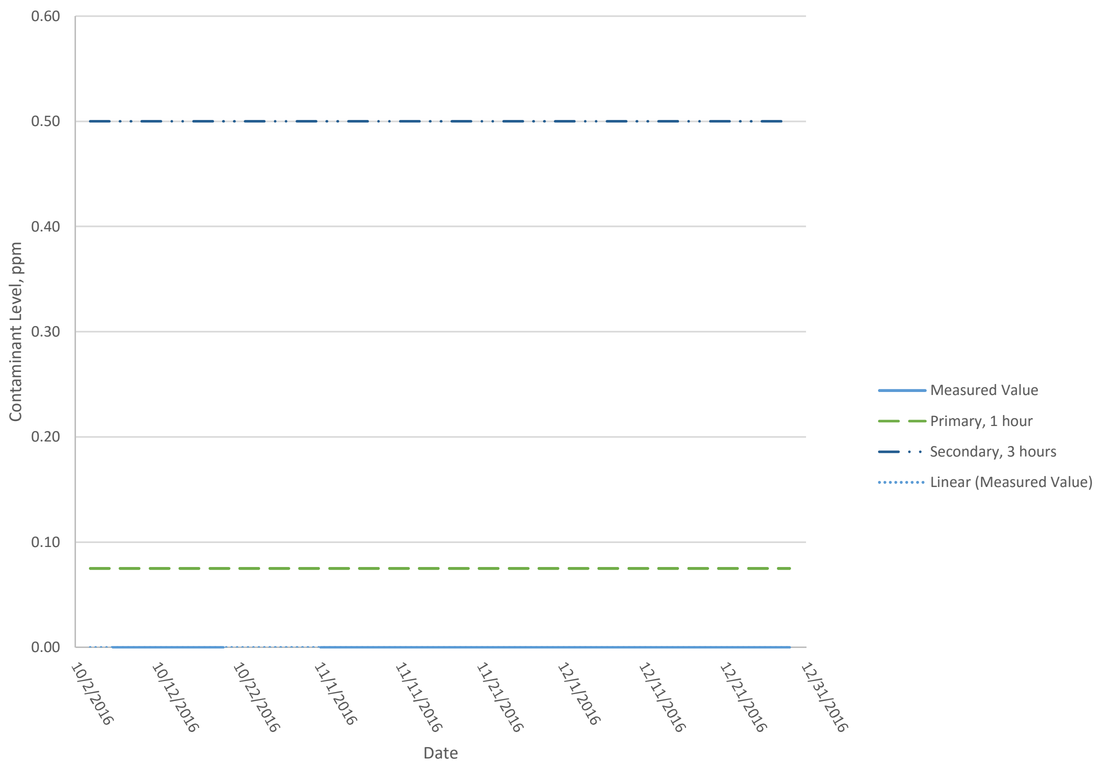

Figure J-10. SO_2, Location E, outdoor.

Appendix K – Graphs of O_3

Graphs present O_3 data per location and either indoor values or outdoor values. Graphs include the primary and secondary EPA limit of 0.070 ppm averaged over 8 hours for comparison. Note that the data on these graphs have not been averaged according to the time suggested: they are presented only as point in time. The EPA limit is only applicable to outdoor contaminant levels and have only been presented on indoor graphs for reference. The indoor and outdoor graphs have y-axes forced from 0.000 to 0.080 ppm. The primary and secondary limit was not exceeded indoors or outdoors at any location during this study. Graphs presenting data as indoor versus outdoor contaminant levels or as I/O ratios have not been included as all indoor values were measured as 0.000 ppm.

Figure K-1. O_3, Location A, indoor.

Figure K-2. O_3, Location B, indoor.

Figure K-3. O_3, Location C, indoor.

Figure K-4. O_3, Location D, indoor.

Figure K-5. O_3, Location E, indoor.

Figure K-6. O_3, Location A, outdoor.

Figure K-7. O_3, Location B, outdoor.

Figure K-8. O_3, Location C, outdoor.

Figure K-9. O_3, Location D, outdoor.

Figure K-10. O_3, Location E, outdoor.

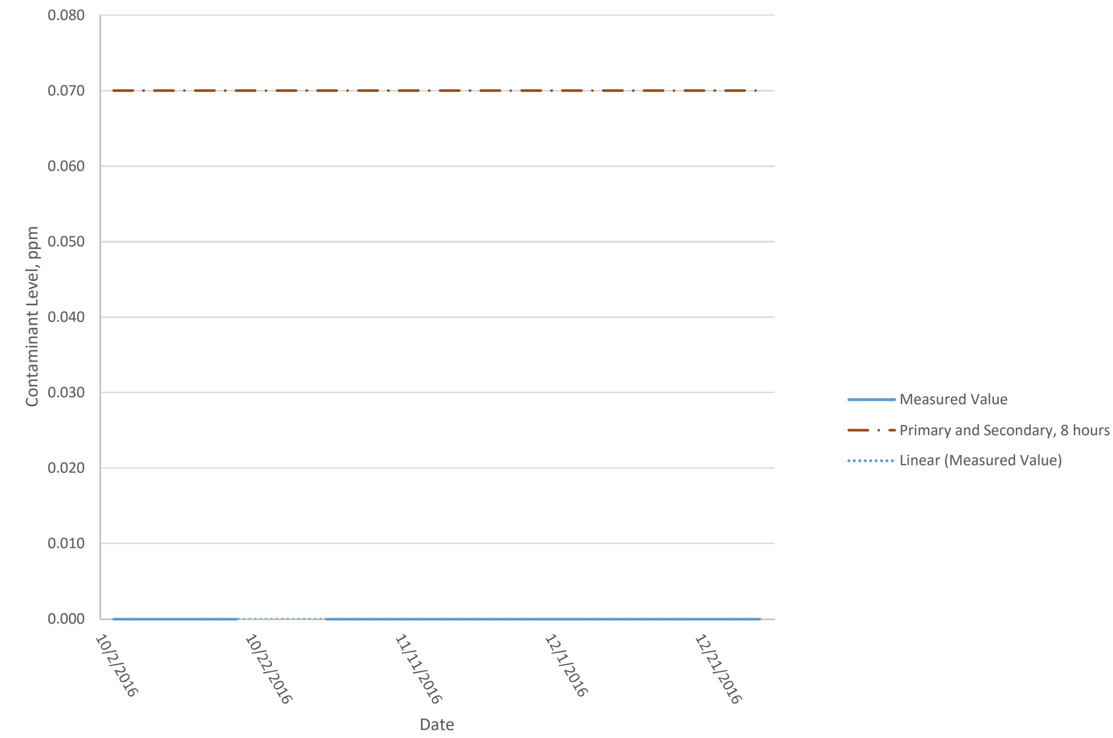

Figure K-1. O_3, Location A, indoor.

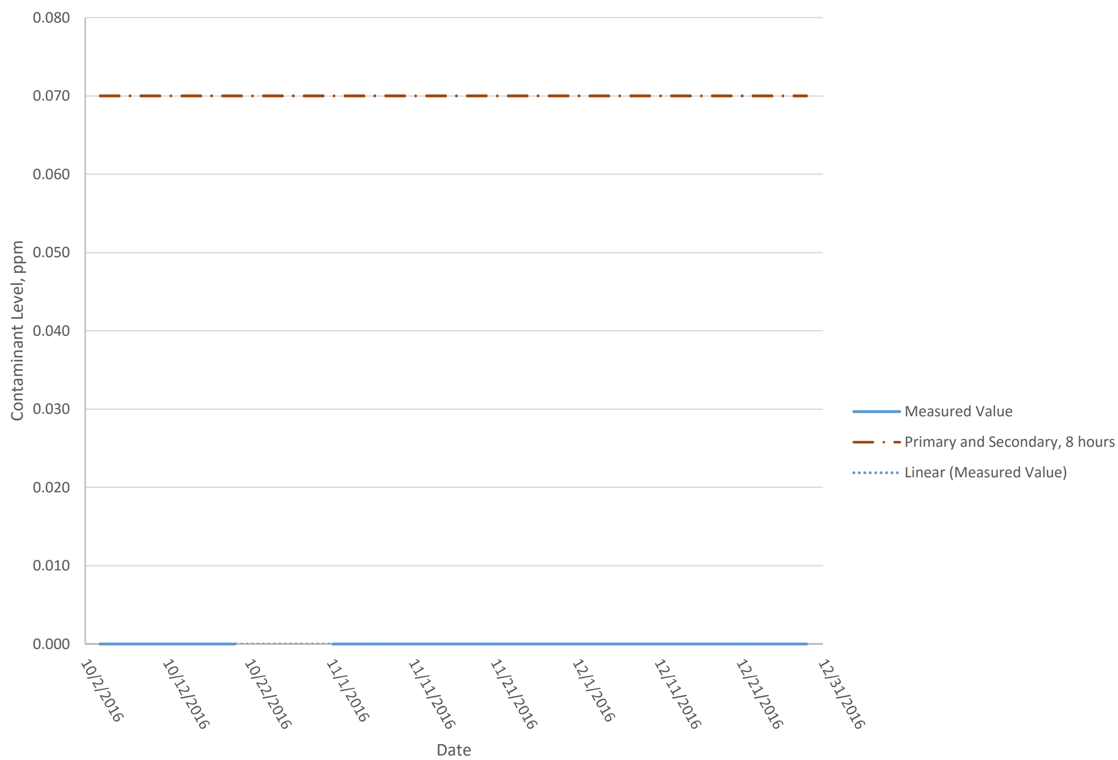

Figure K-2. O_3, Location B, indoor.

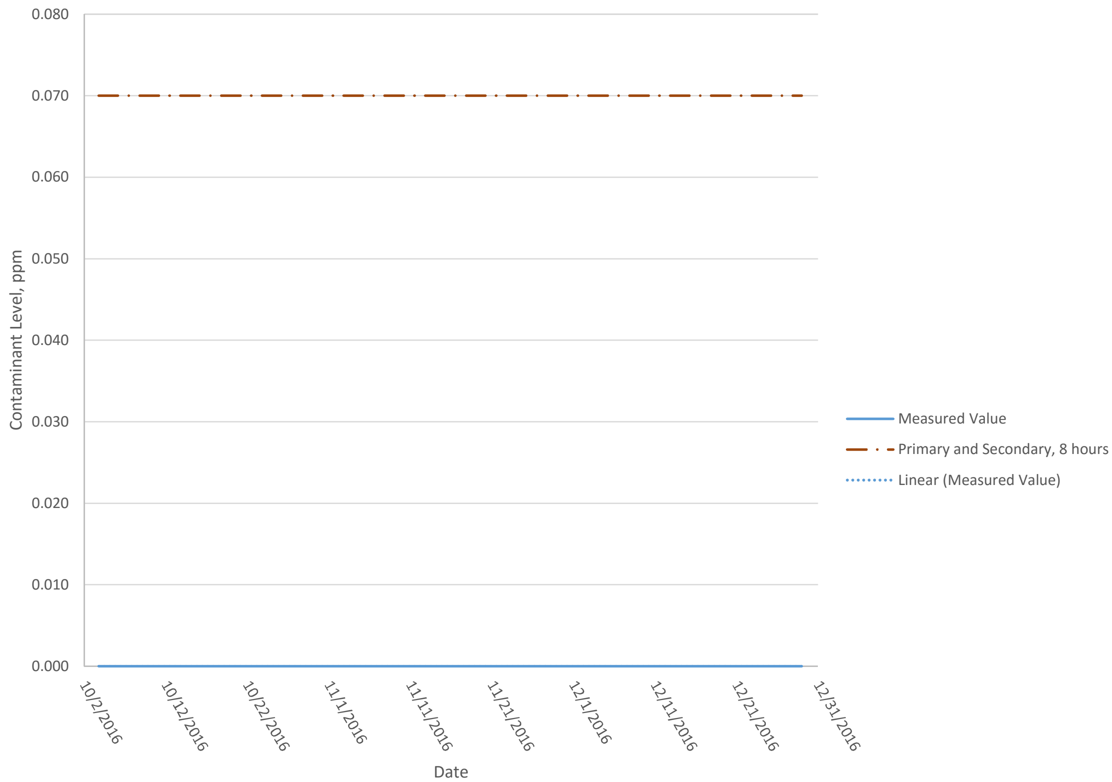

Figure K-3. O_3, Location C, indoor.

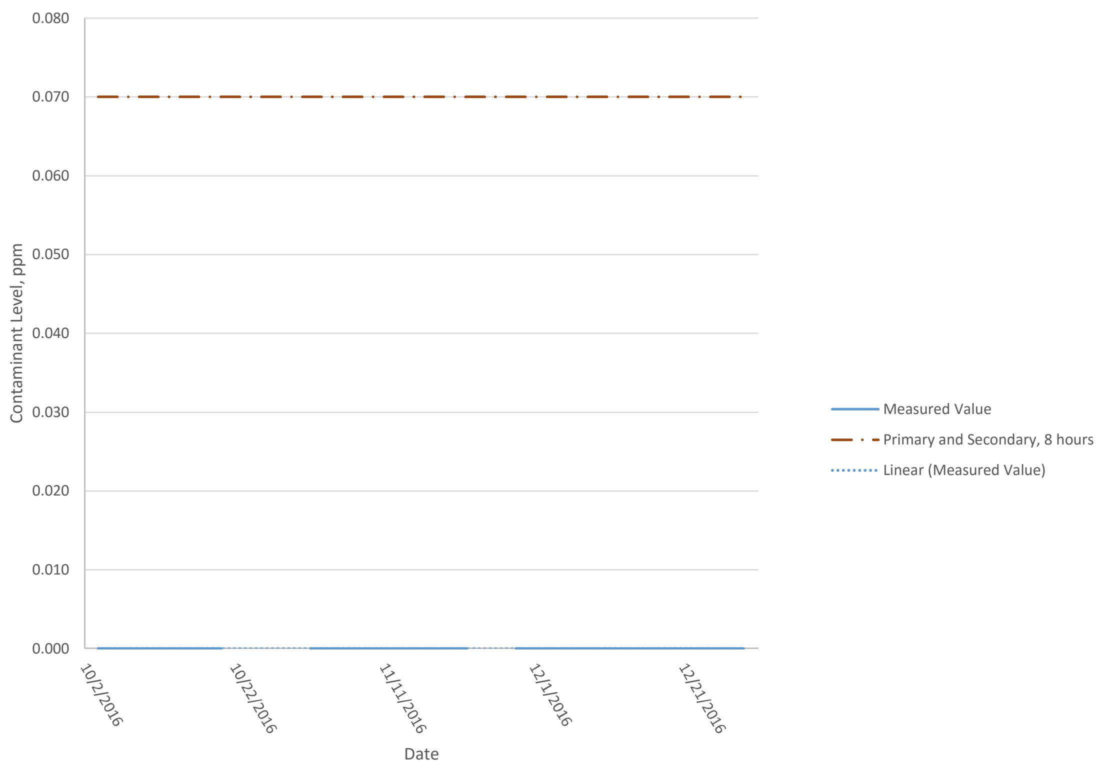

Figure K-4. O_3, Location D, indoor.

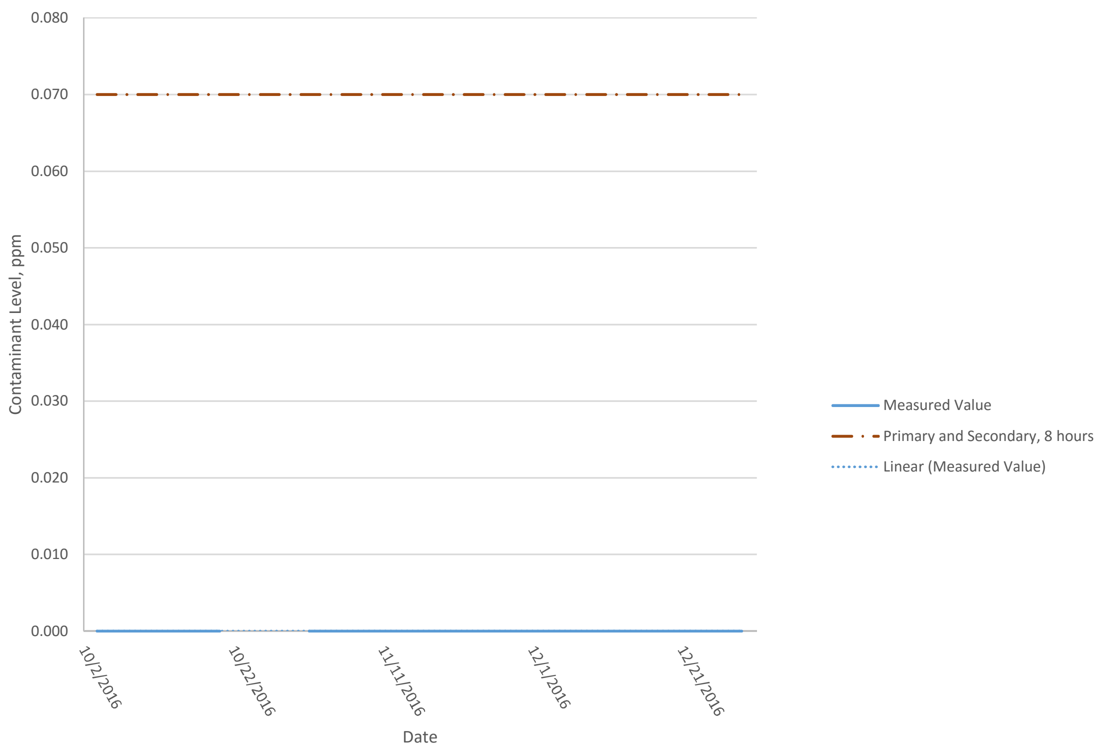

Figure K-5. O_3, Location E, indoor.

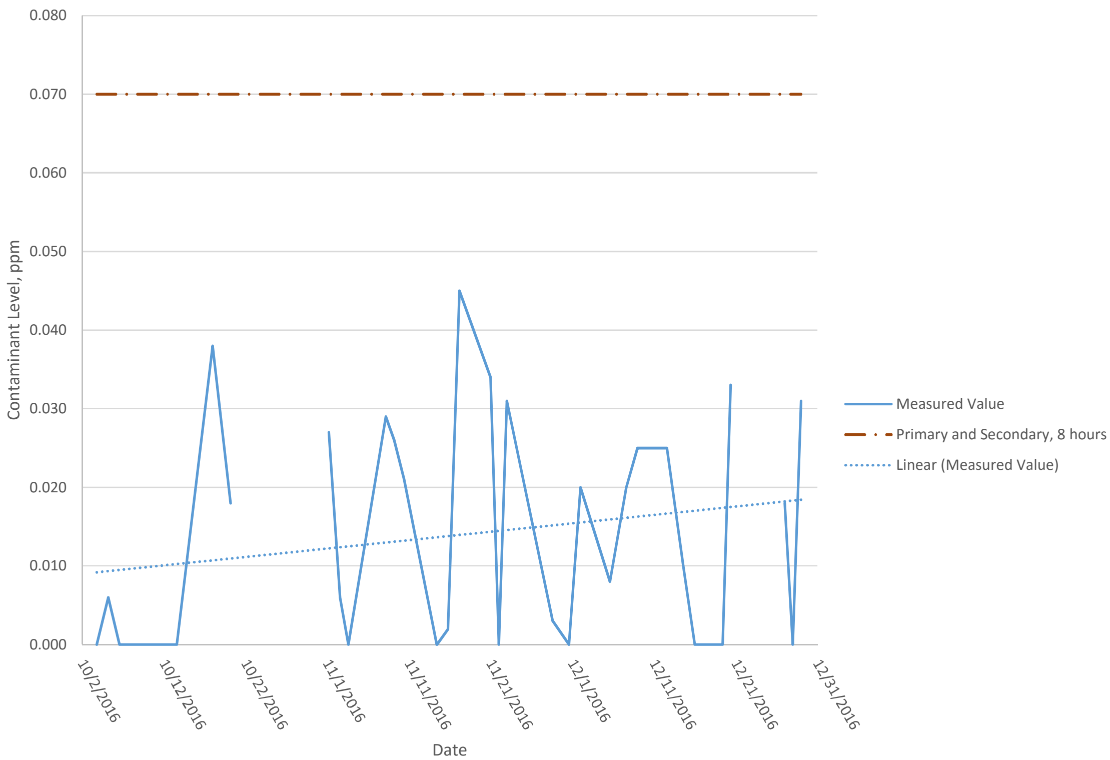

Figure K-6. O_3, Location A, outdoor.

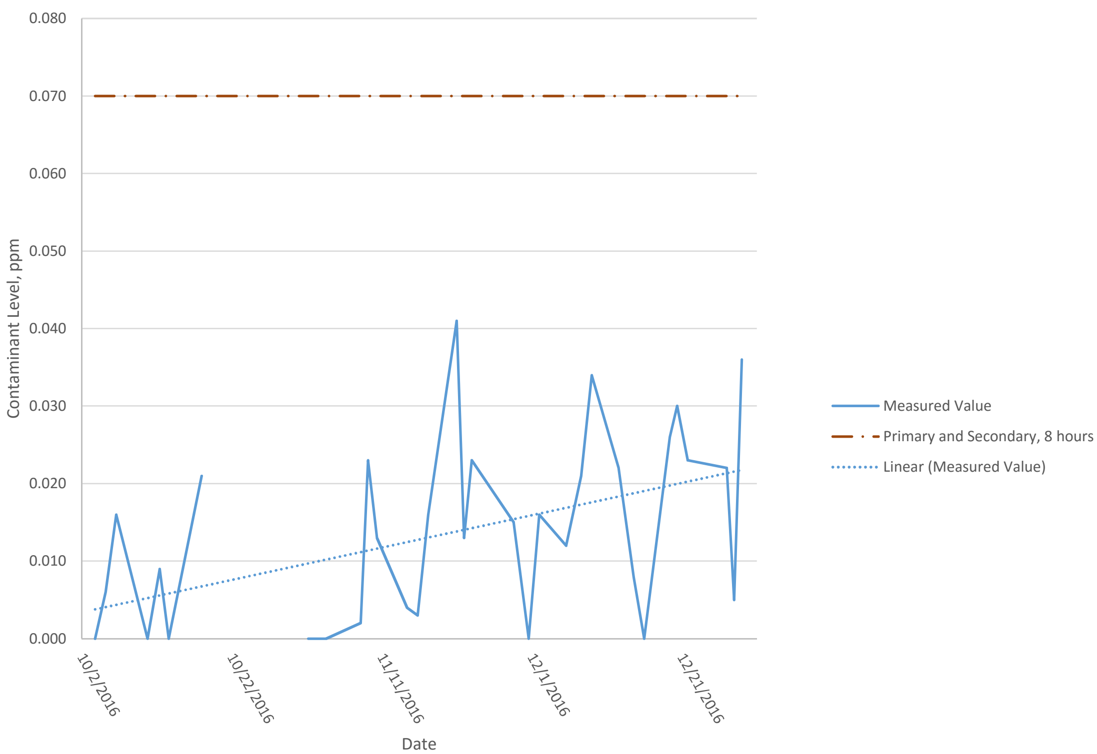

Figure K-7. O_3, Location B, outdoor.

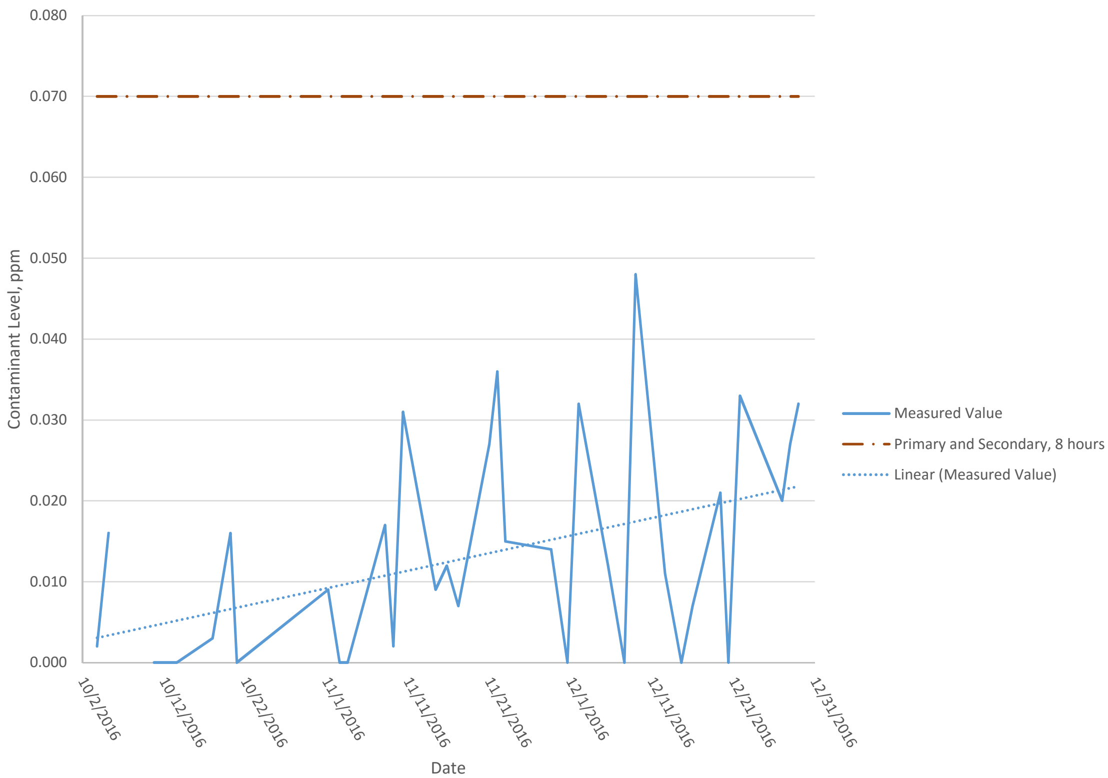

Figure K-8. O_3, Location C, outdoor.

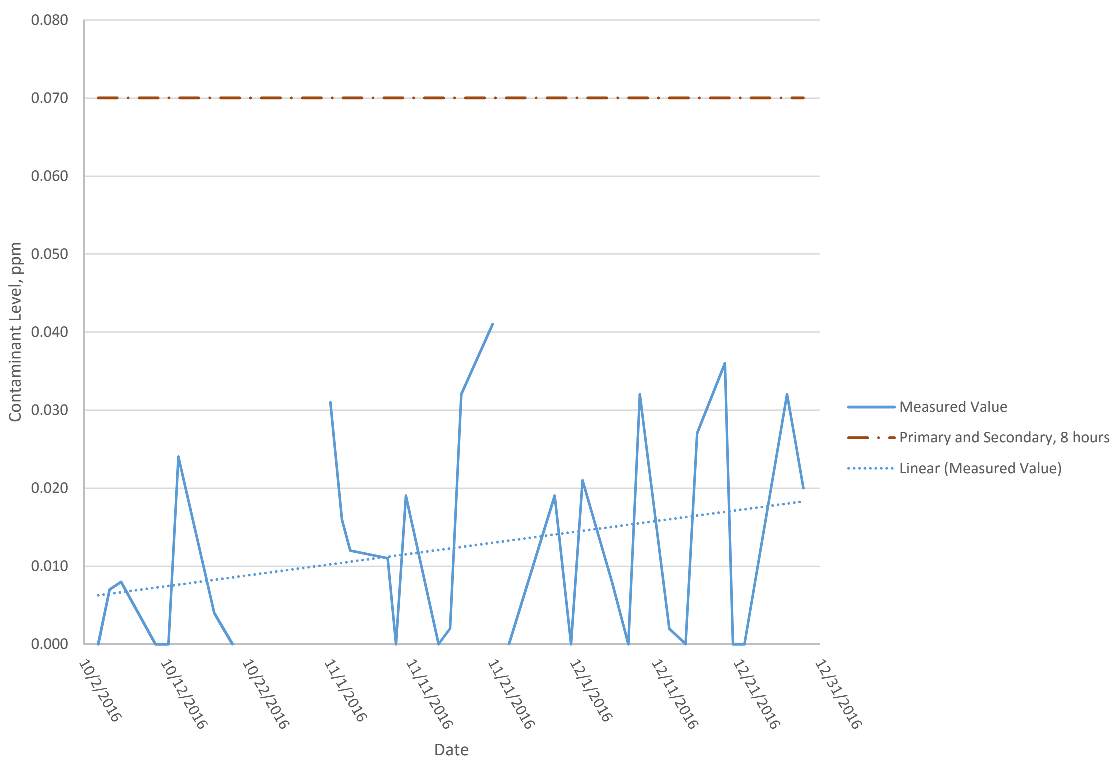

Figure K-9. O_3, Location D, outdoor.

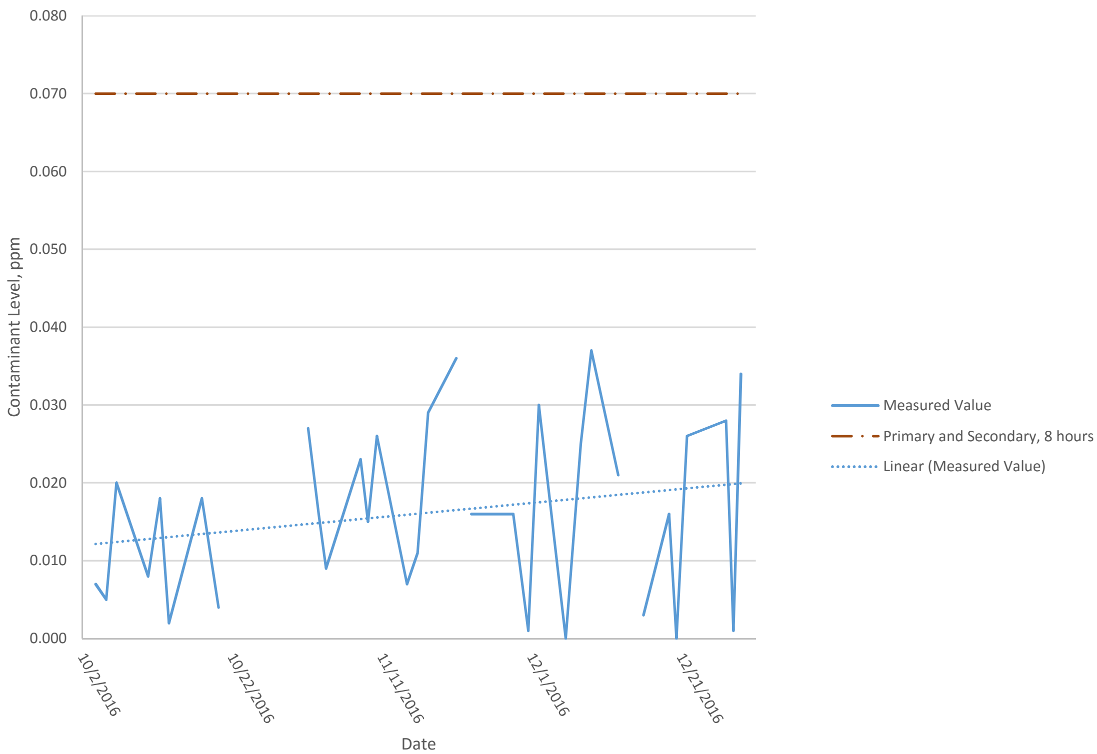

Figure K-10. O_3, Location E, outdoor.

Architectural Engineering

Capstone Report Approval Form

Master of Science in Architectural Engineering -- MSAE

Milwaukee School of Engineering

This capstone report, entitled ñRelationship Analysis between Select Indoor and Outdoor Pollutants in Milwaukee Area Office,ò submitted by the student Haily Fernald, has been approved by the following committee:

Faculty Advisor: ______________________ Date: _______________

Prof. David Grassl, MSEV, PE

Faculty Member: ______________________ Date: ________________

Dr. Deborah Jackman, Ph.D

Faculty Member: ______________________ Date: ________________

Dr. Nadya Shalamova, Ph.D