DEVELOPMENT OF AN AMMONIA EMISSION PROTOCOL AND PRELIMINARY EMISSION FACTOR FOR A CENTRAL TEXAS DAIRY

A Thesis

by

ADAM JOSEPH ROSE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2003

Major Subject: Biological and Agricultural Engineering

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Approved as to style and content by:

Saqib Mukhtar (Co-Chair of Committee)	Bryan Shaw (Co-Chair of Committee)
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ABSTRACT

Development of an Ammonia Emission Protocol and
Preliminary Emission Factor for a Central Texas Dairy.
(May 2003)

Adam Joseph Rose, B.S., Texas A&M University
Co-Chairs of Advisory Committee: Dr. Saqib Mukhtar
Dr. Bryan Shaw

A protocol was developed to measure ammonia emission concentrations from dairies using an isolation flux chamber. A hybrid dairy in Comanche County, Texas, was measured for one week each during August 2002 and January 2003. Sixty total ammonia samples were taken from the free stall barn, open lot, mixing tank, separated solids, compost, and two lagoons using the developed protocol. The ammonia concentration measurements were made using a chemiluminescence analyzer located inside a mobile laboratory. From the emission concentrations recorded, it was estimated that 9.68 metric tons of ammonia were produced from this dairy per year. An emission factor of 13.34 ± 28.80 kilograms per day per thousand head of cattle (kg/day/1000 head) was estimated for this dairy (±95% confidence intervals) during summer conditions. For winter conditions the emission factor was 12.05 ± 12.89 kg/day/1000 head. The 11% difference of the emission factors from summer to winter conditions was predominantly from the change in ambient and control volume temperatures (a mean difference of approximately 25 degrees Celsius), differences in source temperatures, and seasonal variability in husbandry. The adsorption of ammonia onto different polymer tubing used in pollutant stream conveyance was researched for possible systematic losses. Teflon and low density polyethylene (LDPE) were tested for ammonia losses with treatments of: temperature, length, and inlet concentration. Inlet concentration and temperature were significant factors used to describe ammonia adsorption for Teflon, whereas LDPE was also affected by tubing length. These factors were used to create a model to correct the summer dairy measurements for ammonia losses, resulting in an emission factor increase of 8.3% over

the original value obtained from the flux chamber. A nitrogen mass balance was performed to estimate the amount of nitrogen available for ammonia formation as excreted – 177.5 kilograms per year per animal (wet basis). The amount of ammonia excreted per year was also estimated to be 26.63 kilograms per year. The measured ammonia emitted from the dairy was five times less than the ammonia excreted and thirty-six times less than the total nitrogen excreted.

I dedicate this thesis to my lovely wife Jennifer, my family, and my close friends. Without your support I could never have finished this endeavor.

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I would like to thank each of my committee members: Saqib Mukhtar, Bryan Shaw, and Denis Phares, for your generous support and guidance through the long and sometimes difficult process that is required in researching and writing a thesis.

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CHAPTER I

INTRODUCTION

Agricultural facilities are estimated to produce from 50%-90% of the anthropogenic ammonia in the United States (Misselbrook et al., 2000; Pain et al., 1998). Dairy operations in the United States emit an estimated 21,200 tons of ammonia annually (Battye et al., 1994; EPA, 2001). This ammonia is a precursor to small particle formation as well as a source of eutrophication and acidification to both ground and water. The actual emission rate of ammonia from dairy facilities is not directly known, but rather is estimated by the use of an emission factor, which is defined as the estimated average emission rate of a given pollutant for a given source, relative to units of activity. Several studies have been conducted to determine the most appropriate emission factor for a dairy given specific climates and husbandries. Each study focuses on a specific technique to detect and measure the ammonia from the area source on the dairy and also on the specific nature of the dairy. There has been no research focused on Texas dairies, which have climates and management practices different from the bulk of the research currently being conducted in Eastern Europe and the Eastern United States (Battye, et al, 1994). This creates a problem when attempting to use a potentially non-representative emission factor to describe the ammonia production at Texas dairies. State Air Pollution Regulatory Agencies (SAPRAs) use emission factors to estimate pollutants from industries in regulation and permitting, but there is currently no established Texas emission factor for ammonia from dairies. The Texas Commission on Environmental Quality (TCEQ), the Texas SAPRA, does not currently use an emission factor to permit or regulate emitted ammonia for the dairy industry.

This thesis follows the style and format of the *Transactions of ASAE.*

The Environmental Protection Agency (EPA) implemented particulate matter with an aerodynamically equivalent diameter of less than 2.5 microns ($PM_{2.5}$) standards in 1997 in response to health concerns. The Clean Air Act revisions in 1997 established a timeline for compliance with these new $PM_{2.5}$ standards, recognizing that a lead time would be required to meet the new standards. The EPA is currently monitoring and identifying $PM_{2.5}$ sources. Areas not in compliance with the 1997 standards will be identified in 2002-2005, and states not in compliance will then have up to 10 years to implement their plans. Research (Walker et al., 2000) has shown a direct link to ammonia volatilization and small particle formation of secondary $PM_{2.5}$ from ammonium ions. Therefore, the formation of ammonia from dairy operations plays a role in secondary $PM_{2.5}$ formation. Atmospheric ammonia that reacts with acids to convert into aerosols is estimated to comprise a majority of secondary $PM_{2.5}$ particles (Ueda et al, 1999; Singh et al, 2001).

The long-term goal of this research was the creation of a representative emission factor for ammonia at Texas dairies. This factor allowed for daily and yearly emission rate estimates, total emissions from dairies, and for the creation of emissions inventories from the unit processes with potential for ammonia emission. These data would be used in deposition and Gaussian modeling as well as permitting and compliance. The current research created the framework for the necessary measurements that must be conducted to obtain a representative emission factor. This framework included the creation of a measurement system and scientifically sound protocol for the measurement of the concentration of ammonia, which was used to determine the emission factor. Specifically, sampling was performed at a dairy in Comanche County, Texas during summer and winter conditions. The sampling encompassed each waste-producing unit process at the dairy. This measurement research was used to develop an estimate of an ammonia emission factor and to correct any problems encountered in the equipment or pre-planned protocol. More research using this technique will be required to develop a representative emission factor.

There were three key individual research objectives that comprise the overall goal of this research. The first was the quantification of the adsorption of ammonia onto perfluoroalkoxy (PFA) polytetrafluoroethylene (Teflon) and low density polyethylene (LDPE). Polymer tubing such as Teflon and LDPE are used predominately in ambient air quality research because of their chemical resistance, but adsorption of ammonia is still possible (Kosmulski, 2001). This adsorption was evaluated with respect to concentration, temperature and tubing length to statistically determine the amount of ammonia that is adsorbed onto Teflon and low density polyethylene tubing. By characterizing the ammonia response to the system, the system response was modeled and effectively removed. In short, if any ammonia was lost due to conveyance in a system, this loss was quantified and replaced through modeling. This also aided in the correction of the emission factor created from the sampling protocol.

The second objective was the evaluation of ammonia emissions sampling protocol at all waste producing operations in a commercial dairy operation by using an isolation flux chamber and chemiluminescence analyzer. This objective was pivotal to the central goal of the research: development of an ammonia emission factor. By using the emission concentration from the ground level area sources (GLAS) of the dairy with the necessary corrections and calibrations, an emission factor was developed. Measurements were made in typical summer and winter conditions to simulate the seasonal temperature variations in Texas. The waste producing operations initially targeted for this research were: free stall barns, composting, open lots, lagoons, solids separators, mixing tanks, and open lots.

The third objective was the completion of a nitrogen mass balance. By surveying the operations of a dairy, collecting information on herd management practices, and using established dairy nitrogen standards, the amount of total nitrogen excreted per year was estimated. The results of this work were compared to direct sampling and measurement of the nitrogen content as excreted by the herd. Standards are also present for the mass of ammonia as excreted by the herd. These values were used as a comparison to the first, direct measurement method: the isolation flux chamber. The two different approaches to excreted nitrogen estimation were also compared. The amount of nitrogen excreted from the herd gave a theoretical limit on the amount of ammonia available for volatilization.

Using two distinct methods and correcting for systematic error ensured that both the sampling protocol and resultant emission factor values were representative of Texas dairies. This research aimed to produce an accurate ammonia emission factor by starting from unit processes. It detailed the factors that affect the adsorption of ammonia by developing an empirical relationship, and it established a measurement protocol to quantify the ammonia emissions from a Texas dairy. Using both of these outcomes, an ammonia emission factor for Texas dairies was estimated. Ammonia emission and volatilization are dependent on physical factors, husbandry, and solid waste management. These factors vary from region to region, and must be accurately estimated for this region for a representative estimation of ammonia released from Texas dairies.

CHAPTER II

LITERATURE REVIEW

Agricultural facilities, livestock and poultry production in particular, have been reported to be one of the largest contributors of ammonia (NH_3) released into the atmosphere. Some published accounts place the percentage of ammonia production from animal agriculture at 50-85% (Asman, 1992). Recent reports subdivide the contribution of agriculture into component animal groups, estimating that cattle and calf operations result in 44% of the total annual ammonia in the United States (Figure 1) (Battye et al., 1994). Ammonia is the major basic neutralizing gas found in the atmosphere and thus plays an important role in the neutralization of acidic atmospheric gases. These acidic gases are generally formed from the oxidation of sulfur dioxide and nitrogen oxides, but show dependence on the concentration of acids present in the atmosphere. Depending on the acids present, different forms of ammonium ions may be formed. There are five gas, liquid, and solid phase reactions that summarize typical ammonium aerosol formation, the key secondary $PM_{2.5}$ component. (McCulloch et al., 1998).

$$NH_{3(g)} + H_2O_{(l)} \longrightarrow NH_4^+ + OH^- \quad \text{(Ammonium and Hydroxide)} \quad (1)$$

$$NH_{3(g)} + H_2SO_{4(l)} \longrightarrow NH_4HSO_{4(l)} \quad \text{(Ammonium Hydrogen Sulfate)} \quad (2)$$

$$NH_4HSO_{4(l)} + NH_{3(g)} \longrightarrow (NH_4)_2SO_{4(l,s)} \quad \text{(Ammonium Sulfate)} \quad (3)$$

$$NH_{3(g)} + HNO_{3(g)} \longleftrightarrow NH_4NO_{3(s)} \quad \text{(Ammonium Nitrate)} \quad (4)$$

$$NH_{3(g)} + HCl_{(g)} \longleftrightarrow NH_4Cl_{(s)} \quad \text{(Ammonium Chloride)} \quad (5)$$

These reactions create the ammonium ion that forms into an aerosol, which appears as a major component of atmospheric aerosols and precipitation. Atmospheric aerosols are the main component of particulate matter of a size less than 2.5 microns ($PM_{2.5}$), which has come under national prominence due to newly formed laws. $PM_{2.5}$ is known to penetrate into the lungs, causing health problems. In 1997 the Environmental Protection Agency (EPA) set a 24-hour average $PM_{2.5}$ concentration at 15 micrograms per cubic meter ($\mu g/m^3$) and the annual concentration average at 65 $\mu g/m^3$ (Code of Federal Regulations (CFR), Part 58).

Estimates of the atmospheric lifetime of ammonia range from approximately 0.5 hours to 5 days (Aneja et al., 2001). This short lifetime is the result of conversion of ammonia (reactive) to the ammonium ion (relatively stable) and subsequent deposition. Due to its short lifetime, ammonia is most likely to deposit close to its source. Once in the atmosphere, ammonia that is not dry deposited or scavenged by raindrops (wet deposition) will undergo conversion to ammonium aerosol. The lifetime of ammonium is typically longer, on the order of 5-10 days (Stewart, 1970).

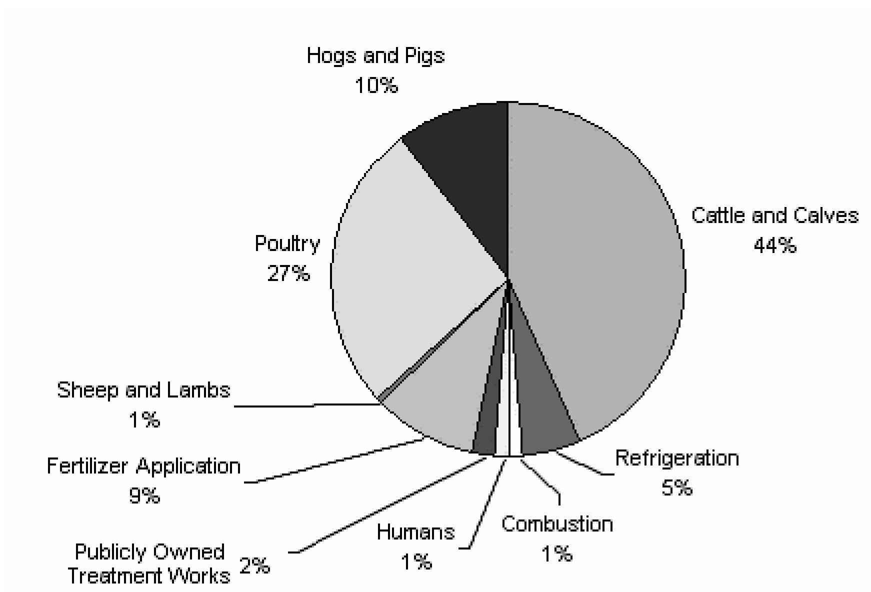


Figure 1. Anthropogenic Ammonia Sources and Percentages in the United States.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) is a federal act, enacted in 1980, that provides broad Federal authority (through the United States Environmental Protection Agency) to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. For ammonia this act allows for fines or facility closure if over 100 pounds of the pollutant is emitted and not reported from a facility. Questions arise as to the applications of this Act to animal feeding operations (AFOs). First, the period over which the mass of pollutant may be emitted is not stated (it is assumed to be 24 hours for this discussion), and AFO emissions are more or less continuous. Second, it is not known if each source from the AFO will be characterized separately or treated as one entire source. If treated separated, then 100 pounds (per day) of ammonia could be released from each source (lagoon, free stall, etc.). Current accepted ammonia emission factors for dairies range from 0.076 to 0.142 pounds of ammonia per day per animal (lb/day/animal) (Warn et al., 1990; Van der Hoek, 1998). Thus, a dairy with as little as 710 animals could exceed the 100 pound per day limit, assuming that the time frame is 24 hours and the entire facility is treated as one source. This becomes an issue in pollution enforcement and permit renewal or application, as there were 97 dairies in Texas of size greater than 700 cows in 1997 (EPA, 2001). When a Texas ammonia emission factor for dairies is approved for regulatory use, a factor as high as 0.142 pounds of ammonia per day per year would mean that most if not all of the 97 dairies in Texas as of 1997 would have to report the emission of ammonia as a hazardous waste and possibly pay fines for the emission. The correct emission factor for Texas dairy ammonia emissions is necessary to represent the actual emission of ammonia. Actual enforcement of these criteria on dairies has not occurred as the CERCLA language is still vague and enforcement is lax.

Properties of Ammonia

Ammonia is a colorless, corrosive, alkaline gas with an extremely pungent odor that can be detected in concentrations of 17 parts per million (PPM) (Holland, 2001). Ammonia is very soluble in water, and is a good solvent. Ammonia exists in the atmosphere in the gas phase, and is subject to gas-phase reaction with photochemically produced hydroxyl (^{-}OH) radicals, reaction with gaseous nitric acid (to form particulate ammonium nitrate), and with aerosols to form ammonium salts (Singh et al., 2001). Ammonia that does not react in the atmosphere can adsorb to water molecules and re-enter the local environment in the form of acidic rain, disrupting the pH of biological systems (Kangas and Sanna, 2001). Atmospheric ammonia deposition alters the species composition and biodiversity of ecosystems and causes acidification and eutrophication of soils as well as leaching of nitrogen to surface and ground waters. The transport of nitrogen to rivers and seas causes eutrophication, visible predominantly as algae formation. Acidifying deposition from ammonium reduces the pH of soils and waters affected and causes leaching of aluminum, threatening the vitality of forests and fish stocks.

The Texas Commission of Environmental Quality's (TCEQ) (formally the Texas Natural Resource Conservation Commission (TNRCC)) Toxicology and Risk Assessment (TARA) Section Staff use Effects Screening Levels (ESLs) to evaluate the potential for effects to occur as a result of exposure to concentrations of constituents in air (TNRCC, 2001). ESLs are based on data concerning health effects, odor nuisance potential, effects with respect to vegetation, and corrosion effects. The EPA and the TCEQ do not regulate ammonia as a hazardous air pollutant or a criteria pollutant, but it is monitored as an ESL chemical. If predicted or measured airborne levels of a constituent exceed the screening level, adverse health or welfare effects would be expected to result. ESLs are further divided into short term and long term. Short term indicates a one-hour averaging period, and long term indicates an annual averaging period. The current ESLs for ammonia (NH_3) are summarized in Table 1 below.

Table 1. Effect Screening Levels for Ammonia in Texas.

		Short Term		Long Term	
Substance	Chemical Abstracts Service (CAS) Number	$\mu g/m^3$	PPB	$\mu g/m^3$	PPB
Ammonia	7664-41-7	170	250	17	25

(Holland, 2001)

Typical Dairy Waste Production Processes

Figure 2 details the largest waste components at a typical dairy that contribute to ammonia production. In this case the dairy composts its solids on the premises.

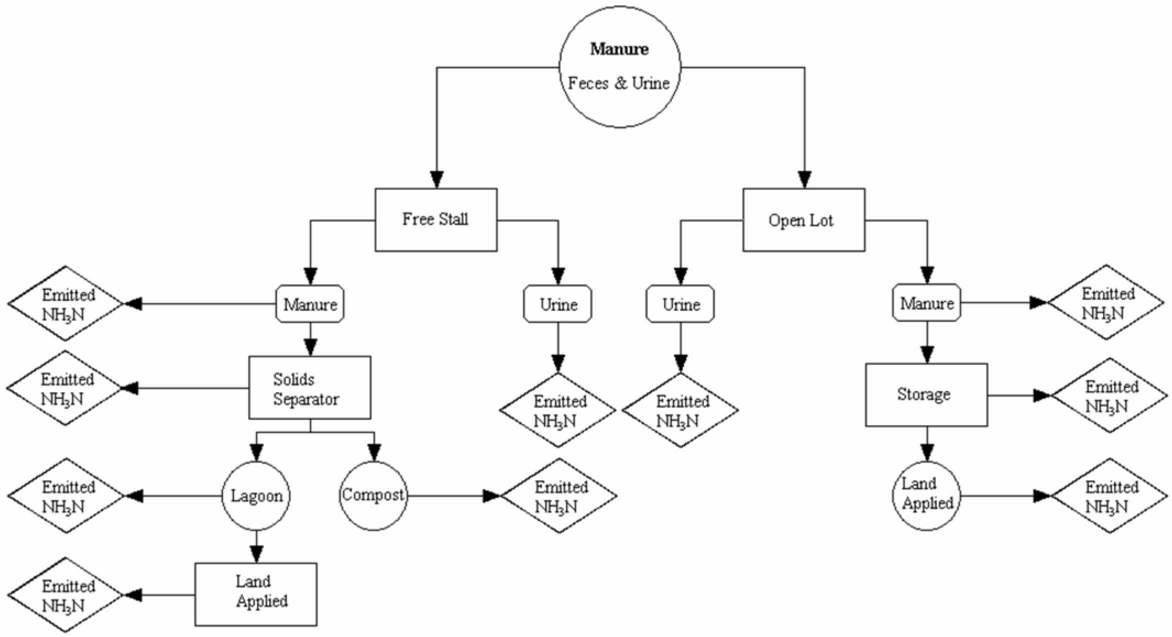


Figure 2. Ammonia Sources from Waste Management at a Dairy.

The free stall barn is used to house predominantly high milk producing cows. The standard free stall barn has a feed alley in the center of the barn separating two feed bunks on each side. On each side of the barn is an alley between the feed bunk and the first row of free-stalls, and an alley between the first row of free-stalls facing the feed bunk and a second row of free-stalls facing the side-wall of the structure. These are the primary areas of manure accumulation. Varieties of bedding materials are used in free-stall barns for animal comfort and to prevent injury. Straw, sawdust, wood shavings, and rubber mats are the most commonly used materials but bedding may also include sand or composted manure solids (Battye et al., 1994). Accumulated manure in free stall barns is typically removed either by scraping or by a flush water system. The flush system collects manure by utilizing a large volume of water introduced on the concrete flooring. The water is introduced at the head of the paved area, and a slope along the length of the barn carries the slurry into receiving pipes. The effluent water is then transported either directly to a lagoon system or through a mechanical or gravitational solids separator to remove some settleable solids. If the solids content of the slurry is significantly high, pumps may be required to transport the effluent to its destination. If not, open channels or pipes using gravity will be sufficient.

An open lot is used in warmer climates for lower producing or dry cows. The lot is a confined area that has unlimited access to feed bunkers, water, and has an open structure to provide shade and limited shelter from the elements. Manure produced in open lots is typically removed by scraping using a tractor-mounted blade, although flush alleys are also common. The rate of manure accumulation is generally higher near feeding bunkers and watering holes. The scraped manure is usually stockpiled for subsequent disposal by either land application or composting.

The emission rate of ammonia from a dairy is due in large part to the types of housing and subsequent manure management practices. A study in the United Kingdom (Pain et al., 1998) relates the husbandry of dairy cattle with the percentage of total emission of ammonia (Table 2). These relationships were determined by measuring the amount of total nitrogen present in each waste process and estimating the amount of ammonia produced as a percentage of this nitrogen. The percentage of ammonia from nitrogen varied from 15 to 59% depending on the dry matter content in the waste.

Table 2. Waste Management Practices and Their Ammonia Sources.

Management Source	Total Emissions
Housing	28%
Storage	17%
Land Spreading	50%
Grazing	5%
TOTAL	100%

Ammonia Formation Processes

Further understanding of the chemical and biological processes that occur in manure allows for an estimation of the ammonia that is released from input elemental nitrogen. The conversion of urea ($CO(NH_2)_2$) to NH_3 (Equation 8) is the primary source of ammonia production in livestock, requiring only hours for substantial conversion and days for complete conversion (Asman, 1992). Uric acid conversion (Equation 9) is also important in the formation of ammonia. Rapid processes convert about 35% of the total organic nitrogen initially in manure to ammonia. Over longer time periods, a total of 50-70% of the organic nitrogen can be converted to ammonia (Thompson and Meisinger, 2002). The degradation of both urea and proteins is affected by pH, temperature, and moisture content (Erisman, 1989). These physical differences make it difficult to standardize factors such as those displayed in Table 2.

Dissociation:

$$NH_3 + H_2O \xleftrightarrow{pH,T} NH_4^+ + OH^- \quad (6)$$

Volatilization:

$$NH_{3(l)} \xleftrightarrow{T} NH_{3(g)} \quad (7)$$

Hydrolysis of urea:

$$CO(NH_2)_2 + H_2O \xrightarrow{Urease} CO_2 + 2NH_3 \quad (8)$$

Aerobic decomposition of uric acid:

$$C_5H_4O_3N_4 + 1.5O_2 + 4H_2O \rightarrow 5CO_2 + 4NH_3 \quad (9)$$

Mineralization:

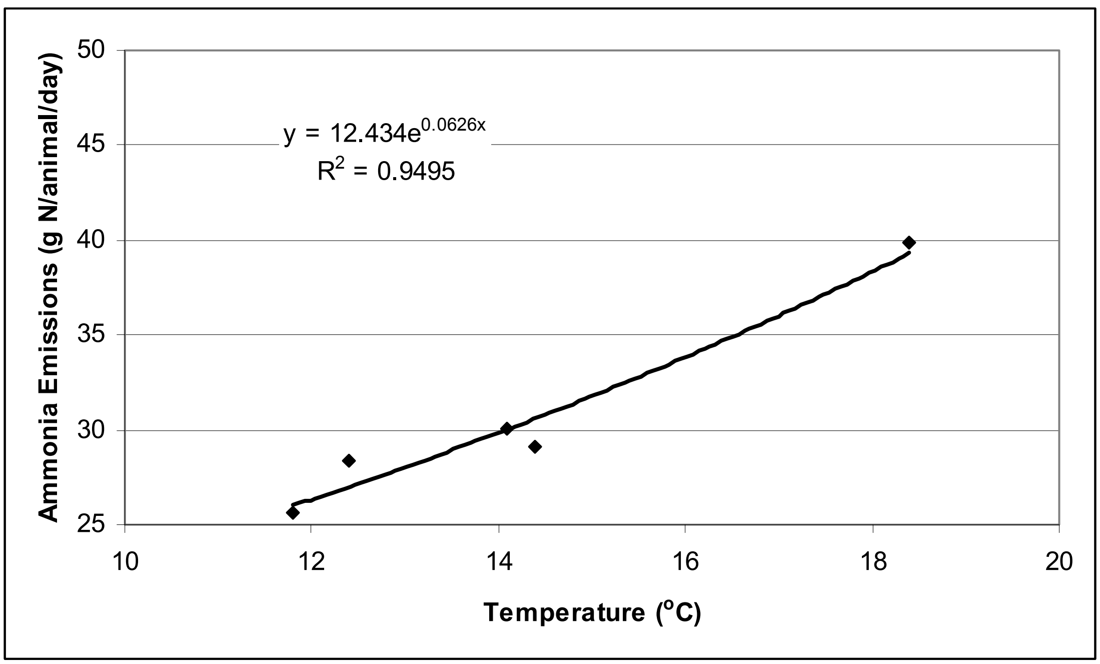
$$\text{Undigested Protein} \rightarrow NH_3 \quad (10)$$

Losses reported from aerobic systems range from 30-90% of total nitrogen, while anaerobic storage has losses from 10-75%. This stems from a lack of oxygen prohibiting the aerobic decomposition of uric acid (Buijsman et al., 1987). The mineralization of undigested protein produces the majority of the ammonia in the first one to two weeks after excretion. Attempts have been made to estimate the total formation of ammonia from nitrogen containing compounds, with losses ranging from 24% to 99% from 7 to 25 days (Lauer et al. 1976; Beauchamp et al. 1978). Some direct ammonia measurements have been made from cattle urine. Stewart (1970) reported 90% losses of ammonia from urine on wet soil and 24% losses from urine on dry soil. It was proposed that less infiltration occurs on wet soil, increasing the residence time and thus the ability for ammonia to volatize into the atmosphere.

The properties of ammonia make it of public and regulatory interest. It is therefore important to accurately quantify the mass of ammonia that is emitted from various sources in agriculture. Dairies are one source that does not have a unified and accepted emission rate estimate. By developing an emission factor, or a factor that is used to predict the emission rate, the emission rate of any dairy can be quantified.

Factors Affecting Ammonia Emissions

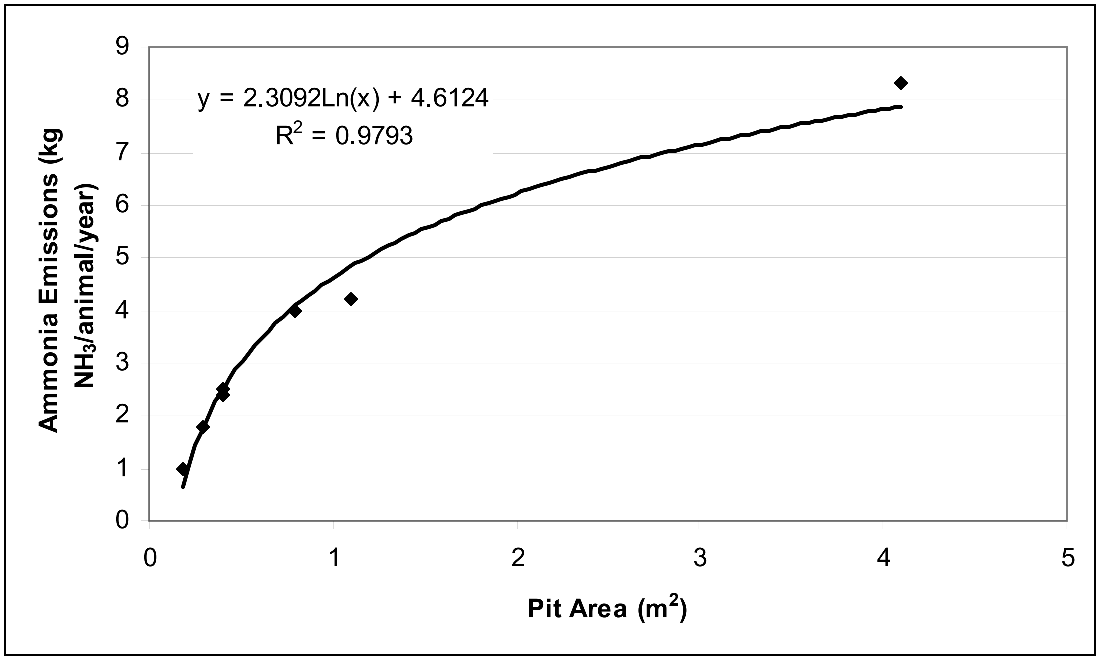
A strong relationship (Figure 3) exists between temperature and ammonia emissions. EPA (2002) presented research to study the relationship between ammonia emissions and ambient air temperature inside a mechanically ventilated dairy house. This original work was performed by Steenvoorden et al. (1999). No methods or materials are discussed in the EPA research, and the original research was in Dutch.



(Steenvoorden et al., 1999)

Figure 3. Relation of Ammonia Emissions and Temperature.

In addition to temperature dependence, ammonia is correlated to surface area (Figure 4) of the ground level area source (GLAS) of areas such as feed lots and lagoons. In this work Steenvoorden et al. (1999) also conducted research with hogs in The Netherlands to determine the relationship between pit size and ammonia emissions.



(Steenvoorden et al., 1999)

Figure 4. Relation of Ammonia Emissions and Surface Area.

Phenomena That Produce Ammonia Emissions

Ammonia is produced from animal wastes in different manners based on the source of the ammonia (urine or feces or a combination), and the types of processes that create the ammonia. The processes affect the ammonia production by the way in which it is handled after it is formed – such as the difference from scraped piles and a lagoon system. After the ammonia has been formed, it must be emitted into the atmosphere to be detected. There are two distinct ways that ammonia may be emitted into the atmosphere from a potential source: diffusion and mechanical stripping. Each plays a role in the total emission of ammonia, and each may be affected by the manner in which the ammonia emission concentration is measured.

The first mechanism of ammonia emission is diffusion. Diffusion is a passive bulk transfer action that relies on a concentration gradient. Ammonia molecules will move from a higher concentration to a lower concentration. Fick's First Law of diffusion governs this movement. Fick's Law states that for gases diffusing through air, the flux J is proportional to the concentration gradient $\left(\frac{dC}{dx}\right)$ times a proportionality constant (D) called the diffusion coefficient (Equation 11).

$$J = -D\frac{dC}{dx} \tag{11}$$

The concentration of ammonia decreases as the distance from the solid-gaseous boundary increases. Immediately above this boundary the concentration of ammonia is at the maximum. Thus, the bulk transport of ammonia is normal to the surface of the area source, as this is a maximum of the gradient function. If the control volume for this system is at steady state, the emission of ammonia is constant assuming a gradient exists. If the volume is sufficiently stagnant, the ambient concentration may asymptotically approach the boundary layer concentration. In this case there will be little or no diffusion of ammonia across the boundary layer: however, it is unlikely that the saturation concentration of ammonia will be reached, as 700 volumes of ammonia can be adsorbed by one volume of water at standard temperature and pressure (Erisman and Draaijers, 1995).

The second mechanism for ammonia emission is mechanical stripping. In this event a mechanical force alters the boundary layer and changes the concentration of ammonia. This occurs in turbulent ambient wind events and physical disruption of the ground or gas layer itself. The first function of stripping is the creation of a gradient from the boundary layer to the surrounding layers. This creates a flux as defined by Fick's law. The second is the mechanical conveyance of ammonia in the boundary layer. In several measurement techniques the user defines the flow rate, which affects the surface wind speed over the source to be tested. Due to stripping, the surface wind speed must be well characterized and accurate. The wind speed affects the turbulence at the boundary layer, and the higher the turbulence at the boundary layer, the higher the emissions from that boundary layer (Hinds, 1999). This relationship does not hold over the course of expectant wind speeds, and a higher limit occurs above which the ammonia is diluted to a point such that it is no longer detectable.

Published Ammonia Emission Factor Work

Several studies have been conducted to attempt to quantify the amount of ammonia emitted from dairy facilities. In these studies, an emission factor is created from ammonia or nitrogen concentration measurements. This factor is then used to estimate the total emissions of ammonia from the dairy. The bulk of this research was conducted in Europe, specifically the Netherlands and Great Britain. The differences in the final emission factors developed by each study are a function of the factors that influence ammonia production at the dairy. These factors include the nitrogen content of the feed, the conversion efficiency of feed nitrogen to waste nitrogen, the housing system, and the process by which the ammonia is stored (waste handling). Most summary reports do not provide the level of detail needed to accurately use the emission factor for emission estimation (Arago et al., 2001). In addition, autonomous research has citied the same source with different values for the same emission factor (Battye et al., 1994; Arago et al., 2001). A majority of these emission factors use a mass balance attempt to estimate ammonia emission (Table 3). This method is flawed for use over broad regions because ammonia creation and subsequent atmospheric release is dependent on physical factors such as temperature and humidity, management practices such as free stall or open lot dairies, and waste management techniques such as land application or injection. Cattle nutrition is another source for variability. The feeding rations vary seasonally, spatially, and over the course of time as new techniques and better management practices are implemented. Table 3 summarizes some of the different values to be discussed by type, location, and applicable notes on methodology. The average emission factor from this table is 18.55 kilograms of ammonia per animal per year, with a standard deviation of 5.7 (six factors).

Table 3. Dairy Ammonia Emission Factor Summary.

Number	Source	Emission Factor ($kg\text{-}NH_3$/animal-year)	Country or Region	Methodology
1	Asman, 1992	23.0	Europe	Manure Nitrogen Analysis
2	Buijsman et al., 1987	14.8	Europe	Manure Nitrogen Analysis
3	Battye et al., 1994	18.9	USA	Mass Balance
4	Van der Hoek, 1998	28.5	Europe	Manure Nitrogen Analysis
5	AP-42*, 1994	12.6	USA	Gas Chromatograph
6	Pain et al., 1998	19.42	United Kingdom	Manure Nitrogen Analysis

* Compilation of Air Pollutant Emission Factors – Volume I (EPA, 1994)

Asman (1992) completed the first comprehensive ammonia emission factor study. The emission factor from this study was determined using a mass balance. The mass balance followed nitrogen flows in the livestock, specifically the nitrogen-phosphorous (N/P) ratio. The emission of ammonia was computed from changes in the N/P ratio from collected manure samples. This research was conducted by a group of agricultural scientists in The Netherlands, and a derivation of this work is used for the European emission factor. After the emission factor was determined, the total ammonia emissions were estimated by multiplying the factor by the number of dairy cattle in each European country. This information was used as an input to a modeling program to grid the emission of ammonia across Europe. Most research into emission factors in Europe uses the same initial emission factors as the Asman report, but varies the final factor by making adjustments to climate and management practices (Buijsman et al., 1987).

Buijsman et al. (1987) conducted research with the same methodology in attempt to modify the ammonia emission factor. The Asman (1992) dairy ammonia emission factor is 21% higher than the Buijsman factor due to differences in applied emission factors for each country and the classification of animals. This stems from the differences in volatilization of ammonia based on management practices. For example, 50% greater losses of ammonia were found if land applied manure was applied to grassland rather than arable soil (Thompson et al., 1990). This occurs because the grass inhibits slurry infiltration into soil, increasing the residence time and surface area of ammonia. In this case even multiple application of the same emission factor work leads to an increase in emission factor differences.

The National Acid Precipitation Assessment Program (NAPAP) is an interagency of scientific research, monitoring, and assessment on the effects of sulfur and nitrogen oxides on the environment and human health. The NAPAP emission factor used in a 1985 study is utilized in the current Compilation of Air Pollutant Emission Factors – Volume I (AP-42) (Warn et al., 1990). The 1985 NAPAP study subdivides dairy facilities into confined and ranging dairy. This report does not address the housing of animals, only the application of animal waste. The measurement of ammonia in this study was conducted using a dilute sulfuric acid solution, with ammonia being measured with the standard Nessler Method, a mercuric and potassium iodide solution used to determine ammonia concentrations. The study yielded an emission factor of 12.25 kilograms per animal per year for confined dairies and 20.41 kilograms per animal per year for ranging dairies. The value obtained from confined dairies was based on three data points. The ranging dairy emission factor was determined from 1978 data based on stocking rates and animal weights. The significant difference can be attested to the two separate ways in which measurements were made and the small amount of data collected for confined dairies.

A large portion of United States ammonia emission factor work is based on older European studies (Battye et al., 1994). The recommendations for applicable factors include all European factors, Compilation of Air Pollution Emission Factor – Volume I (AP-42) factors, and National Acid Precipitation Assessment Program (NAPAP) factors. The 1980 NAPAP factor received the lowest quality rating (e) for the emission factor for dairy ammonia. NAPAP used a dilute sulfuric acid to collect ammonia, and then used the indophenol method and gas chromatograph analysis to quantify ammonia. No specific mention of the analytical methods used is provided (Battye, 1994). The current AP-42 emission factors use the NAPAP emission factor. In addition to the NAPAP emission factor, the Asman emission factor developed in 1992 is also frequently used. Although recent work (Aneja, 2001) has developed more sophisticated methods to measure swine waste processes, published dairy ammonia work has lagged behind. This has led to a spectrum of emission factors being used (Table 3).

Some recent work (Thompson and Meisinger, 2002) has attempted to quantify ammonia volatilization from land applied cattle manure. In this research wind tunnels were used to create the sample and passive diffusion grab samples were used to capture the sample. An acid trap was used to collect the sample before analysis with the salicylate method. This research estimates that 45% losses of ammonia from applied unincorporated slurry and as little as 0-12% if immediately plowed into soil. This research was completed for only one waste process: other processes such as lagoons, dry lots, and freestalls are not as well characterized.

The European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC, 1994) developed a series of emission factors for different livestock based on a nitrogen mass balance. This research determined the amount of nitrogen excreted by subtracting the amount of nitrogen in milk and growth from the nitrogen consumed in the feed. From the remaining nitrogen excreted, ammonia emissions were developed based on volatilization estimates for each type of waste handling. Table 4 describes the amount of total nitrogen emitted from each manure source.

Table 4. Percent of Total Nitrogen Emitted from Dairy Manure.

Manure	Total Nitrogen Emitted
Slurry* with Surface Cover	2%
Slurry without Surface Cover	9%
Solid Fraction Manure	15%
Liquid Fraction Manure	2%
Deep Litter**	15%

* A mixture of feces, urine, and water.
** Manure of depth greater than 12 centimeters

Pain et al. (1989) determined that losses during spreading of manure were determined to be less than 1 percent, so an emission factor of one percent of total nitrogen was assumed. The emission factors for field applied manure depend on several factors including: season, time required to incorporate into land, slurry or manure, type of tillage, and existence of crop. An emission factor for manure deposited during grazing was also estimated. British studies place the percentage of ammonia from 6 to 10% of total nitrogen excreted. Dutch studies estimate 3-9%, and Denmark 7% (Hutchings et al., 2001) of total nitrogen excreted.

Direct and Indirect Emission Factor Determination

To determine an emission factor for ammonia the emission concentration must be determined. This is the concentration of ammonia that is emitted from the ground level area source (GLAS). Once this concentration is determined an emission rate can be calculated. This rate is determined from the following equation for use with direct measurements.

$$ER = \frac{C \cdot P \cdot MW \cdot FR}{R \cdot T} \qquad (12)$$

where:

ER = emission rate (micrograms per second – μg/s)

C = emission concentration (Parts per million – PPM)

P = atmospheric pressure (Pascals – Pa)

MW = molecular weight of pollutant (grams per mole – g/mol)

FR = flow rate of sampling device (cubic meters per second – m^3/s)

R = ideal gas constant (8.31 Joules per Kelvin-mole – J/k·mol)

T = temperature (Degrees Kelvin – K)

This emission rate is then converted into an emission flux by dividing the rate by the area of the source that created the concentration measured. This flux is calculated so that the emission rate can be determined at any dairy by knowing the size of the GLAS. For example, if a source has a mean concentration of 100 micrograms per cubic meter ($\mu g/m^3$)

of ammonia, and the flow rate through the system is 1 liter per minute (LPM, or 0.001 cubic meters per minute), then the emission rate is 0.1 μg/min. If the area used to determine the concentration was 2 m^2 then the flux is defined as the emission rate divided by this area, which is 0.05 μg/min/m^2. Using this number, if the total area of the GLAS is 1000 m^2 then the total emission rate from the GLAS is 50 μg/min. This procedure is summarized in Equation 13.

$$\left(\frac{ER}{A_1}\right)\cdot A_2 = \left(\frac{C \cdot FR}{A_1}\right)\cdot A_2 = \left(\frac{100\frac{\mu g}{m^3}\cdot 0.001\frac{m^3}{\text{min}}}{2m^2}\right)\cdot 1000m^2 = 50\frac{\mu g}{\text{min}} \qquad (13)$$

where:

A_1 = measurement surface area

A_2 = GLAS area

This is the methodology used to determine emission rates from varying sources and locations. In this case the emission rate from one source has been calculated. If the emission rates from all of the major sources are determined then an emissions inventory has been created. This emissions inventory gives the total emission rate from the entire facility on a yearly basis. By using the emission concentration collected from the GLAS, an emission factor can be created that allows for the emissions inventory to be estimated.

Techniques to Measure Emission Concentration

The emission concentration is the key factor that must be accurately estimated. There are several techniques to determine the emission concentration from the GLAS. The advantages and disadvantages of varying methods will be reviewed and discussed. There are three broad methodologies to estimate ammonia emissions. The first is a nitrogen mass balance. This method estimates the amount of nitrogen in the feed (inlet), and then follows the amount of nitrogen through the waste processes (outlets). The difference between inlet and outlet nitrogen is the amount of nitrogen remaining in different forms on the dairy, such as body reserves and milk. These factors can be estimated such that the amount of nitrogen excreted in the dairy can be estimated. The conversion and volatilization of ammonia are governed by chemical equations of a known rate. Ammonia emission concentrations are a function of several different phenomena including temperature, pH, and concentration directly above the surface of the emitting area (Asman, 1992). These various factors lead to uncertainty in the emission factor. Providing a sound estimate of total ammonia emissions is therefore dependent on the accurate quantification of losses at each waste stage, and this will vary for different management practices and thus for different dairies.

The second methodology involves direct measurement of the ammonia concentration emitted from the GLAS. Measurements of concentrations are made from a source over a period of time and with some amount of conveyance (air flow) to measure the resultant emissions. This concentration is a function of the level of turbulence (the ability of the system to strip away a pollutant), creating a gradient that continues the emission of the pollutant. This turbulence is a function of the flow rate in a closed system and the wind speed in an open system. The flow rate is not only a direct input into the emission rate calculation (Equation 12), but it also affects the emission concentration from the area source through diffusion and mechanical stripping. It is therefore important to accurately determine the concentration at the correct flow rate. The flow rate dependence of ammonia is a topic that many different measurement systems attempt to address (Smith and Watts, 1994).

The final technique is indirect measurement through means such as eddy correlation or open path Fourier transform infrared (OP-FTIR) detection. Indirect measurements typically use remote sensing technology and predictive modeling equations to detect atmospheric ammonia and track it back to its assumed source. These systems are typically complicated to erect and operate, and require a large initial cost for materials and software (Arago et al., 2001). Specific examples of indirect techniques are mentioned below.

Denuder Tubes

Active denuder tubes represent an established method in air quality studies that satisfy an emission factor development requirement for continuous sampling of emissions over relatively long time periods and large plot areas (Reynolds et al., 1998). The denuder is a medium through which an air stream is passed in a manner similar to a filter for particulates. In the case of NH_3 it is a fibrous material, usually glass, treated with a substance (such as citric acid) that will react with NH_3 to form a solid. The denuder is usually an active sampler utilizing a pump to pull a known flow rate of air through a disk of the treated material in a filter holder located at the point of measurement. Passive denuders work under the same assumptions but use ambient wind to transport the air stream. Once a sufficient layer of solid has formed on the medium, a gas chromatograph is used to determine the concentration of ammonia from the solid. Typically the solid is thermally desorbed from the medium so that it may be reused and analyzed with greater ease (Fitz, 2002). The concentration is determined over the specified time frame, and the emission rate is then calculated using Equation 12. A disadvantage of denuder tubes is the time over which they sample. Since the adsorbed pollutant must be removed after the sample has been taken, the sample is an average over the time that the fibre was exposed to the sample. This average must be used in conjunction with an average flow rate estimated over the region. This lack of a real time measurement eliminates that ability to see trends in the release of the pollutant, and incorporates possible human error in the determination of the exposure time as well as sample handling. In addition, the concentrations that are recorded are from the ambient air, and while they were created from the GLAS, it is nearly impossible to know exactly which emission concentration came from which source. This method assumes that the vertical flux through the grid can be correlated directly to the GLAS source nearest the grid. This introduces error due to the random nature of the pollutant movement and the chemical processes likely to occur while in transit.

Optical Absorption Techniques

Eddy covariance is another method used to estimate pollutant concentrations. This micrometeorology technique uses a vertical array of wind speed and temperature sensors operated in parallel, with effluent sampling occurring in parallel. The system typically consists of varying instrumentation including: a three axis symmetrical sonic anemometer, an infra-red gas in closed path mode and custom written software that calculates the fluxes in real time, performing complex coordinate rotation and flux averaging as required. In eddy covariance a flux of gas may be measured with the eddy covariance method when turbulence, generated by the movement of air immediately above the GLAS surface, transports the gas perpendicular to the ground. Gas flux is determined by calculating a covariance statistic of the fluctuations in vertical wind velocity and the entity of interest (pollutant concentration) from a series of sequential measurements made over time (Arago et al., 2001). To sufficiently capture significant turbulent motions, eddy covariance instrumentation must be capable of accurately sampling wind or gas concentration at least several times per second. The instrumentation may be costly and considerable care must be taken to ensure that environmental conditions will not violate assumptions underlying the methodology. Instruments are typically deployed from fixed meters to 10's of meters above the surface (Zhu and Desjardins, 2000). Depending upon instrument height above the surface, eddy covariance measurements are representative of a surface-atmosphere flux occurring over an upwind area on the order of acres. The thermodynamic properties of ammonia have been intensely studied, and the quality of the input laser beam can be related back to ammonia concentration. In other indirect methods the flux density of ammonia can be determined using meteorological data. An example of a general micrometeorological equation that relates flux to atmospheric conditions is shown in Equation 14. As with most indirect methods, this equation requires sensitive and near-instantaneous records of ambient conditions. In addition, it employs correction terms to allow for applications beyond the original assumptions of the fundamental equation (eddy covariance in this case). These correction factors can be highly variable in some cases (Denmead, 1994).

$$F = \overline{\varpi' \rho_g'} + \frac{\overline{\rho_g}}{\overline{\rho_a}} \cdot \frac{\mu}{1 + \mu\sigma} E + \frac{\overline{\rho_g} H}{\overline{\rho} C_p \overline{T}} \qquad (14)$$

where:

F = flux density

ω = vertical wind speed

μ = ratio of dry air and water vapor molecular weights

σ = ratio of water vapor and dry air densities

ρ = total air density

C_p = specific heat of air (isobaric)

T = absolute ambient air temperature

E = water density correction term

F = heat transfer correction term

– ≡ variable ensemble average

One potential disadvantage is the estimation that must take place concerning truly random events. The concentration is measured above the surface of the source, and predictions must be made as to the actual location and concentration from the source. This technique is best used when the appropriate equipment can be located centrally, and may be difficult when an open path to the source is not easily obtainable (such as inside a free stall dairy or milking parlor).

Wind Tunnels

Another method involves using specially fabricated wind tunnels (Figure 5). These wind tunnels are placed in contact with the GLAS and a known volume of air is swept over the surface. By keeping the system open to the ambient environment there are fewer possible containment influences that may bias the measurements. An advantage to wind tunnels involves using sweep air over the system to cause a wind speed effect similar to the natural environment. This most closely mimics the ambient environment that would naturally cause the gradient and the emission of a pollutant. In addition, the measurement occurs directly from the GLAS, so there are no time dependent calculations to estimate the origin of a pollutant. One disadvantage of the wind tunnel method is the flow rate required. As previously mentioned, the emission concentration is a function of the flow rate over the emitting surface. In the case of wind tunnels, the flow rate and the geometry of the chamber dictate the surface wind speed, and there has been little effort to standardize wind tunnel design or protocol (Schmidt and Bicudo, 2002). Thus, if one wind tunnel has different dimensions than another, the bulk wind speed will vary and so will the reported concentration. To obtain an emission factor for dairies, the wind tunnel would be placed in contact with the GLAS and a known velocity of contaminant free sweep air would be passed over the source. The pollutant stream leaving the tunnel could be measured using a variety of analyzers. Measurements have been made to estimate the relationship between tunnel velocity and concentration in an attempt to standardize the emission concentration (Equation 15) (Smith and Watts, 1994).

$$\frac{E_v}{E_1} = 1.05V^{0.63} \quad r^2=0.685 \tag{15}$$

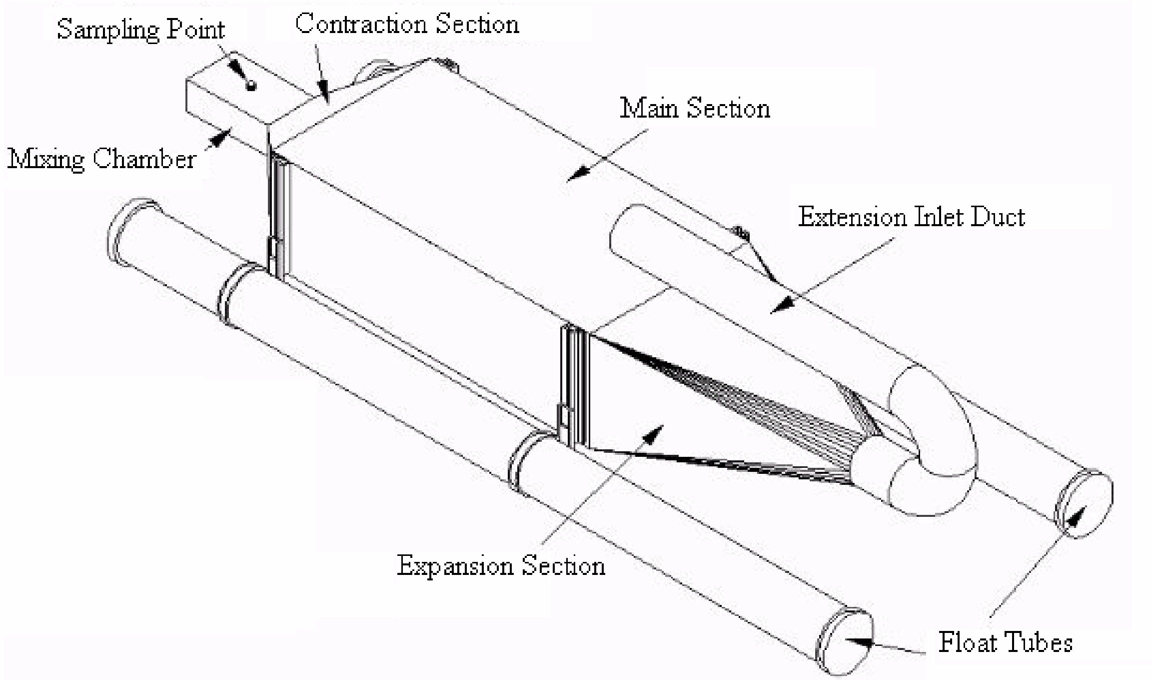
where:

V = given bulk tunnel velocity in meters per second (m/s)

E_v = emission concentration at velocity V

E_1 = emission at 1 m/s

As described in Equation 15, there is not significant correlation between the emission concentrations. This discrepancy can lead to large differences in values measured from a wind tunnel system. The large flow rate required may also dilute species found in small concentrations to a level that makes them virtually undetectable (Neuman, 1999).



(UNSW, 1999)

Figure 5. Wind Tunnel Schematic.

Flux Chambers

The method used in this research will be the isolation flux chamber method. The flux chamber is comprised of two distinct pieces; a cylindrical skirt and a hemispherical top (Figure 6). The chamber is placed in contact with the surface of the GLAS. A known volume of contaminant-free (zero grade) air is transferred into the chamber via polymer tubing. The tubing enters the top of the chamber and wraps around the skirt. The skirt tubing is perforated to allow for homogenous mixing of the zero air. The top of the hemisphere also has an opening to allow for the mixed pollutant air to be removed for sampling. The air is removed using a vacuum pump and routed to an appropriate analyzer. There are other designed holes in the hemisphere to allow for the air not removed from the pump to disperse into the atmosphere. This creates a small positive pressure that isolates the chamber from the environment. This isolation will only occur when a seal has been created with the bottom of the chamber and the area source (Eklund, 1992). A disadvantage to the flux chamber is the strict dependence on flow rate. By its nature the chamber is isolated from the environment, so the emission rate is correlated directly to flow rate, which is set by the user. Considerable work has been done to standardize the flow rate, sampling time, and chamber size, but like the wind tunnel there is a dependence on wind speed (Gholson et al., 1989). The emission of ammonia through diffusion will not be hindered by a lack of ventilation through the chamber (Equation 11) because ammonia is extremely absorbent in liquids. At room temperature one volume of water will dissolve 700 volumes of ammonia, whereas one volume of ammonia is approximately the same mass and density of air at standard conditions (Erisman and Draaijers, 1995). Therefore, the concentration of ammonia in ambient air required to stop emission from diffusion approaches 700 parts per million (PPM) (depending on temperature and pressure). As a comparison, the short term ESL (Table 1) for ammonia is 0.25 PPM, 2800 times lower than this critical concentration. Quality assurance measures are well defined, such as the required flow rates, sampling equipment, and technique itself. The air that is pumped into the system creates the wind speed over the surface of the source. A flow rate of 5 LPM into a standard size flux chamber creates wind speeds from 1-1.5 miles per hour (MPH) (Eklund, 1992). This isolation inherent in the flux chamber allows for very accurate comparison measurements. The system has no dependence on ambient conditions and the source itself is isolated during measurement. Air is supplied before sampling occurs to ‘purge’ the system of previous ambient atmospheric conditions. Typically four residence times are used to ensure isolated conditions (Eklund, 1992). Flux chamber technology has the advantage of being a mature technology, which is easily and dependably deployed to those sources for which it is applicable. It appears most applicable for stationary, well-mixed, infinite sources that occur throughout dairies.

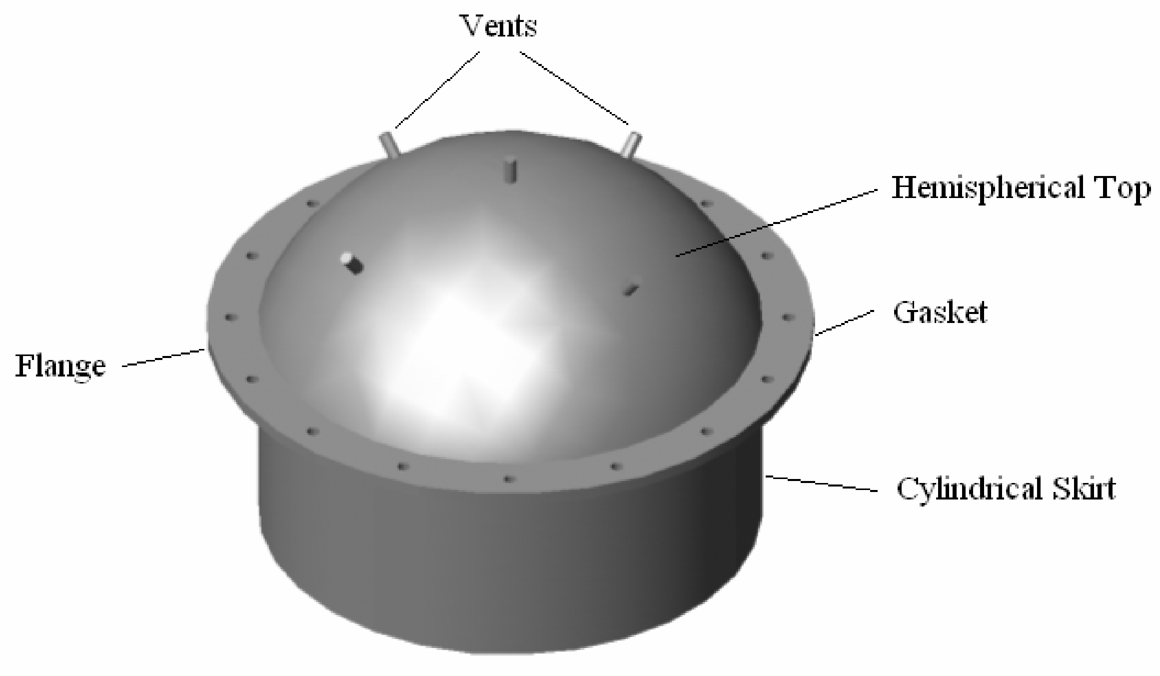


Figure 6. Flux Chamber Design.

The emission of ammonia from agriculture is of significant interest due to the large role it plays in both total ammonia emission and, subsequently, secondary small particle formation. This research will focus on the development of an emission factor protocol for ammonia at Texas dairies. This emission factor will allow for quantification of ammonia from each source within the dairy, and summing these sources will give an emissions inventory of ammonia. A flux chamber will be used to measure the ammonia emission concentration from different sources at the dairy. The protocol developed in these measurements will be refined and documented. In addition, the adsorption of ammonia onto Teflon and low density polyethylene will be measured and quantified through the completion of a randomized complete block design. Losses from adsorption will be established and integrated back into the original estimates from the sampling measurements. The differences between the two factors will be compared and discussed. As a final step, a nitrogen mass balance will be conducted from the feed input, specific husbandry practices of the dairy, and accepted dairy nitrogen standards. These values will be compared to previous emission factors as well as the newly defined emission factor from the isolation flux chamber method. The results of each step in the development process will be reported and discussed.

Research Objectives

The principle goal of the proposed research is the development of an ammonia emission factor that accurately estimates the emission rate of ammonia from unit processes at a dairy. This factor will allow for daily and yearly emission rate estimates and total emissions from dairies and for the creation of emissions inventories from the unit processes located at a dairy. This information will also be in a format that allows for its use by state air pollution agencies (SAPRAs) in the general regulatory and permitting process. This overall objective has been divided into three sub objectives.

Objective One

Complete a nitrogen mass balance throughout a dairy, encompassing each nitrogen source and estimating the total amount of excreted nitrogen.

Objective Two

Evaluate the adsorption of ammonia onto Teflon and low density polyethylene with respect to concentration, temperature, tubing length, and materials to statistically determine the changes that these treatments create in the system.

Objective Three

Evaluate ammonia emissions sampling protocol at all waste management sites in a commercial dairy operation and describe preliminary emission factor results.

CHAPTER III

ADSORPTION OF AMMONIA ONTO TEFLON AND LOW DENSITY POLYETHYLENE TUBING

Introduction

Ammonia is known to be a principle precursor to small particulate matter formation, which is detrimental to human health. In addition, ammonia contributes to acidification of ecosystems when reintroduced through rainfall events (Kangas and Sanna, 2001). Ammonia is an extremely reactive gas: it is very soluble in water and also adsorbs well on most materials. Currently, field experiments are used to determine the emission of ammonia from various sources, such as livestock facilities. This research does not quantify the amount of ammonia that is lost through adsorption of ammonia on different materials under field conditions. With knowledge of the amount of ammonia that is emitted from a source, the total emission of ammonia may be estimated. An accurate and representative estimation of the amount of ammonia produced from a facility is critical for proper environmental permitting and remediation, as well as for the creation of an emissions inventory. An emissions inventory classifies and quantifies all of the pollutant emissions from a particular source. This paper quantifies the adsorption of ammonia onto perfluoroalkoxy (PFA) polytetrafluoroethylene (Teflon) and low density polyethylene (LDPE) under laboratory conditions that simulate conditions when conducting field experiments. If the adsorption of ammonia onto materials such as Teflon and LDPE tubing used in these experiments is significant and is not taken into account, the values that are measured are not accurate. This research aims to quantify this problem and correct it through creation of a predictive model so that measurements are not biased to a lower concentration than actually present at the source.

Properties of Ammonia

Ammonia (NH_3) is extremely soluble in water: one volume of water dissolves about 1,200 volumes of the gas at 0°C, but only about 700 volumes at room temperature and still less at higher temperatures (Erisman and Draaijers, 1995). Compared to water, liquid ammonia is less likely to release protons (H^+ ions), is more likely to take up protons (to form NH_4^+ ions), and is a stronger reducing agent (Appl, 1999). Because strong acids react with it, it does not allow strongly acidic solutions, but it dissolves many alkalies to form strongly basic solutions. Ammonia takes part in many chemical reactions. Ammonia reacts with strong acids to form stable ammonium salts: with hydrogen chloride it forms ammonium chloride; with nitric acid, ammonium nitrate; and with sulfuric acid, ammonium sulfate. Ammonium salts of weak acids are readily decomposed into the acid and ammonia. The ammonia molecule has a pyramidal geometry: one nitrogen atom at the apex of a triangular grouping of hydrogen atoms. The NH_3 molecule has a large dipole moment, and this is consistent with its geometry, a triangular pyramid (Figure 7).

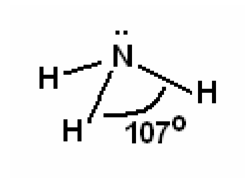


Figure 7. Chemical Structure of Ammonia.

The electronic arrangement in nitrogen obeys the octet rule. The four pairs of electrons (three bonding pairs and one non-bonding lone pair) repel each other, giving the molecule its non-planar geometry.

Adsorption Phenomena

Analysis of gas – solid physical adsorption equilibrium is important to design separation and purification processes as well as description of conveyance affects on materials. The equilibrium between the fluid phase and the adsorbent phase is expressed by adsorption isotherms. The derivation of a scientifically based adsorption isotherm was first achieved by Langmuir in 1918, and assumes monolayer adsorption on a homogeneous surface. Although the Langmuir isotherm was introduced more than 85 years ago, it still remains the most commonly used adsorption isotherm equation (Kosmulski, 2001). The Langmuir adsorption isotherm can be derived from the surface reaction in Equation 16.

$$A + S \leftrightarrow AS \tag{16}$$

where:

A = Adsorbate of interest (Ammonia)

S = Empty surface site (Teflon or LDPE)

AS = Surface species responsible for adsorption

The equilibrium constant for the reaction characterized in Equation 16 is represented in Equation 17 (Kosmulski, 2001).

$$K_{ads} = \theta(1-\theta)^{-1} a^{-1} \tag{17}$$

$$\theta_{AS} = \frac{[AS]}{[AS]+[S]} \tag{18}$$

$$\theta_S = 1 - \theta_{AS} \tag{19}$$

where:

θ= Activity of the surface species

a= Activity of the adsorbate in solution

K_{ads}= Binding constant of surface reaction.

S = Empty surface site (Teflon or LDPE)

AS = Surface species responsible for adsorption

The magnitude of adsorption depends on the binding constant (K_{sat}) and the sorption capacity ([AS]+[S]). Polymers such as Teflon typically have low binding constants, reducing the coverage for an adsorbate given the activity of the adsorbate (a) (Davidson, 1979). However, ammonia has a relatively high adsorbate activity, increasing the coverage for a given binding constant. These competing factors determine the magnitude of adsorption. The relationship between adsorbate activity and coverage is dependent on the binding constant: each binding constant will yield a different adsorption magnitude. Because the activity constant should be high and the binding constant low, some typical assumptions of the behavior of the system cannot be used. In these cases the sorption capacity and binding constant can be determined from Equation 20 (plotting a/[AS] as a function of a).

$$\frac{a}{[AS]}=\frac{a}{[S]+[AS]}+\frac{1}{K_{ads}([S]+[AS])} \tag{20}$$

K_{ads} is a constant value defined by the system, so the coverage is driven by the adsorbate activity in the system, a. Polymers have a low equilibrium constant, so the coverage is low, or there are relatively few full sites compared to sorption capacity on the surface of the polymer (Hobson and Chapman, 1972). Different polymers possess different properties of adsorbate activity, so the amount of full adsorption sites will vary with each polymer. This is the thermodynamic basis for polymer resistance to substances such as ammonia, and why the resistance of each polymer to each fluid is unique.

The chemical structure of ammonia is such that it is very reactive. As shown in Figure 7, the nitrogen atom is at the apex of a pyramid created by a plane of hydrogen atoms in an equilateral triangle. Although this is a covalent bond, the nitrogen-hydrogen bonds have a polar contribution due to relatively strong electronegativity (measured in units of kilojoules per mole) of nitrogen compared to that of hydrogen (3.04 kJ/mol and to 2.2 kJ/mol, respectively, on the Pauling scale of 0 to 4 kJ/mol) (Appl, 1999). This polar contribution, in conjunction with the asymmetrical nature of the molecule, develops a considerable dipole moment. The dipole moment is measured in units of charge · length, and the dipole of ammonia is $6.16 \cdot 10^{-24}$ coulomb · microns orientated up from the base of the pyramid through the nitrogen atom (Appl, 1999). This dipole moment, orientated normal to the base, in conjunction with the structure of the nitrogen atom placement, makes ammonia a strongly adsorbant material. As ammonia approaches a surface, the dipole moment and nitrogen placement draw it into surface sites. Even though the structure of polymers is such that adsorption sites are relatively rare, ammonia is reactive enough to noticeably adsorb on polymers (Kosmulski, 2001).

Several recent studies attempt to quantify the amount of ammonia present in livestock waste (Sommer et al, 2001; Erisman et al, 2001; Aneja et al, 2001). The research of Sommer et al. (2001) focused on the volatilization of ammonia from sow manure on grassland. To conduct this research a mobile dynamic chamber was constructed. This chamber utilized approximately 6 meters of Teflon tubing and an air pump to convey the pollutant stream through denuder tubes. Aneja (2001) measured the ammonia emission concentration from anaerobic hog lagoons using a dynamic floatation chamber. Teflon tubing is used to convey the pollutant stream from the chamber to a stainless steel ammonia converter, and then to a nitric oxide analyzer. The Teflon tubing length requirements are not specified and the system response is not described.

Roelle, et al. (1999; 2002) conducted research to detect nitrogen oxide emissions from agricultural soil. This research utilized a dynamic chamber system and a mobile laboratory up to 10 meters in distance from the chamber. Teflon tubing was used to span the required distance from area source to mobile laboratory. The chamber was also lined with 5 millimeters of fluorinated ethylene propylene (FEP) Teflon.

Laboratory research (Ormeci, et al. 1999) also uses Teflon as a conveyance material. In this research nitrogen oxide flux from agricultural soil is also studied, but under fixed laboratory conditions. Teflon tubing is used to connect the dynamic test chamber to the required analyzer and air supply. In each study nitrogen oxide is being researched, which is not as reactive as ammonia (Ormeci et al., 1999). In each case there is no mention of reactionary problems with Teflon or other polymer tubing used in the conveyance system.

All direct measurement techniques using a dynamic or isolation chamber require conveyance of the pollutant stream to the appropriate analyzer (EPA, 2002). The length requirement of the conveying tubing is a function of the access available to the area source being measured. For dairy operations, some waste operations such as lagoons may be over 100 meters in width, requiring at least 50 meters of tubing to return the sample from the center of a lagoon to a land-based mobile laboratory. Field work by Eklund (1992) using flux chambers mentions that adsorption is a possible factor for tubing longer than three meters.

The goal of this research is to model and predict the behavior of ammonia on Teflon and low density polyethylene (LDPE), taking into account changes in concentration, length (surface area) of material, and temperature. These two polymers are used as a representative sample of polymers used in the ambient aerosols monitoring field. These materials are used as a start to the necessary research due to direct physical impacts on adsorption through surface interactions (Equation 17). Temperature is an intensive property of heat and energy, and is a direct component on the kinetics of adsorption (as described previously). Tubing length is a direct influence on surface area and thus available adsorption sites for a fluid. The different tubing materials have different surface characteristics and chemical resistances that are dependent on both the material ambient conditions and the fluid that is adsorbing onto the material surface. Once a model has been created, experiments that rely on large quantities of tubing to convey ammonia gas may be used to a greater accuracy. The adsorption losses experienced can be predicted and factored into the final concentrations. This paper will develop a model that estimates ammonia losses with variable length, concentration, and temperature. It is hypothesized that the adsorption and possible subsequent desorption of ammonia will be influenced by each of these factors.

Objectives

The overall objective of this paper is to model ammonia adsorption and desorption through Teflon and LDPE tubing. By experimenting with different variables, a model will be created that predicts the amount of ammonia that will be lost under these certain conditions. With the ability to predict ammonia losses, tests that are run using Teflon and LDPE tubing can be modified to represent these losses after the tests have already been performed, or as a factor to use while the experiment is being run. To develop this model the following tasks were realized.

1. Create a laboratory setup that will allow for different physical factors to be varied.
2. Create a dilution system to produce varying ammonia concentrations.
3. Develop an automated program to carry out the necessary experiments.
4. Conduct a factorial experiment to test two temperatures, six ammonia concentrations, two tubing lengths, and two tubing materials.

Methods and Materials

To carry out the adsorption experiments an accurate and precise analyzer was necessary to record the actual concentrations of ammonia that were being produced. An ideal concentration was created using a dilution system detailed in this section of the paper. This is the concentration that the analyzer would measure if there was no loss of ammonia through the materials used in the experiment. By contrasting the actual concentration with the ideal concentration for different conditions, a predictive model could be created. In this experiment a chemiluminescence analyzer (Thermo Environmental Inc. (TEI) Model 17C, Franklin, Massachusetts) was used to measure the concentration of ammonia. The chemiluminescence technique as well as a description of how ammonia is specifically detected and measured is included in Appendix A.1.

This analyzer required periodic calibration to allow for accurate measurements, and in each case standard gases were required to test the system. The development of the necessary calibration equations is outlined in Appendix A.2. These equations allowed a user to input a total volume and a desired concentration, from which the correct concentration of gas was created. Appendix A.3 describes the calibration procedure to ensure that the analyzer is properly working. The lower detectable limit and 24 hour drift of the analyzer were both 1 part per billion (PPB). The response time of the analyzer to 90% of actual concentration was 120 seconds with a ten second averaging time, and the precision was 0.5% of full scale range. The accuracy of the analyzer is a function of the accuracy of the calibration system, but was experimentally verified to be at least ± 2%.

The calibration equations must be used with software in such a way that the output could be converted into a signal and delivered to mass flow controllers. The software used in this research was National Instruments LabVIEW version 5.1.1 (Austin, Texas). The first program developed for this research was a calibration package to calibrate the Model 17C analyzer. The user was prompted to enter the known concentration of the calibration gas, the concentration required at the analyzer, and the total volumetric flow rate required. From this information the software used one of the four sets of equations developed in

Appendix A.2 for calibration. The user selected the species of gas, and based on this selection the software picked the corresponding program by using the system outlined in the block diagram in Appendix A.4. The lines connected the output to the input, and each case diagram was only activated if the corresponding button found on the front panel was depressed. Once the program was activated, the corresponding flow rates were calculated and sent out as a signal to the LabVIEW hardware. The output signal to the mass flow controllers assumed a 100% efficiency of the mass flow controllers to process the signal and output the exact flow rate. In actuality, a linear calibration was added to the signal to ensure that the output signal is equal to the flow conveyed through the controller. There were no drift or linearity discrepancies associated with the calibration factor.

An additional set of software was developed specifically for use with this adsorption experimentation. The adsorption software acted precisely like the calibration software described in Appendix A.4, except only the ammonia equation was required because it was the only chemical being tested. In addition, user controls were added (Appendix A.5). In this case the required concentration was requested, but the cylinder concentration from the actual cylinder in the laboratory was directly input, and the flow rate was set at 2 liters per minute to provide adequate inlet flow to the analyzer. The concentration was initially zero and then was changed to the pre-selected concentration for one hour and then brought back to zero. The user only selected the concentration he or she required. The remaining components of the program were defined by the software to increase precision.

Appendix A.6 details the use of data acquisition hardware and software to convert the signal from the LabVIEW software to the equipment necessary to conduct the adsorption experiments. For this research a National Instruments (Austin, Texas) data acquisition (DAQ) card was controlled with software provided by National Instruments. This allowed for the operation of the mass flow controllers (MCF) and the data logging system. The software setup for this control system is outlined and described in Appendix A.7.
In these experiments Aalborg thermal mass flow controllers (GFC17S MFC Orangeburg, New York) were used. Metered gases entered at the inlet port of the transducer and were divided into two laminar flow paths, one through the primary flow conduit, and the other

through a capillary sensor tube. Both flow conduits were dimensioned and shaped to ensure laminar flows and therefore the ratio of their flow rates was constant. There were two precision temperature sensing windings on the sensor tube. The windings were heated, and heat was transferred through the thin wall of the sensor tube to the gas flowing inside. When gas flow was taking place, some heat was carried from the upstream towards the downstream windings. The resultant temperature dependent resistance differential between the two windings was detected and compensated by the control circuit. The energy required to restore resistance equilibrium to the windings was proportional to the instantaneous rate of flow taking place. Analog output signals of 0-5 volts and 4-20 milliamps were used to calibrate the linear mass flow rate of the transducer. The combined gas streams flowed through a proportionating electromagnetic valve with an appropriately selected orifice. The closed loop control circuit continuously monitored the mass flow output and maintained it at the set flow rate. The mass flow controllers had a two second response time and were accurate to 1.5% of full-scale with a repeatability of 0.5%. The MFCs were tilt dependent, with a 1% change with a 90 degree change in attitude. The wetted materials consisted predominantly of 316 stainless steel and Viton.

Another piece of equipment used in the experiment was a Teflon in-line static mixer. This mixer did not move through the fluid – instead the fluid moved through the mixer. The MFCs forced the fluid into the mixer, where the stream split and was forced onto opposite outside walls. A vortex was created along the centerline axis of the pipe. This vortex was then sheared and the process occurred again with the opposite rotation. The number of times this mechanical action was required was governed by the Reynolds (Re) number of the fluid. If the Reynolds number was above 1000, then the flow was turbulent and six inversions (or elements) were required. If the flow is laminar (below 1000) then 12 elements were required. Although the flow rates and fluid characteristics dictate that this was a turbulent flow (Re>1000), a 12 element mixer was selected to ensure proper mixing. The gases involved should resist fouling, so the extra elements were not a detriment to the system.

Experimental Procedure

The adsorption program (Appendix A.5) was designed to regulate the concentration of ammonia through each tubing material based on the appropriate experiment. The program allowed for the inlet concentration at the inlet of each tubing material being tested for ammonia adsorption to be set, but the times used to change flow rates and concentrations were constant for these experiments. Three sequences were used: warm up, adsorption, and dilution (desorption). When the program began, 100% of the flow was zero grade air. This zero air allowed the analyzer to stabilize and gave a reference zero concentration for the trial. In laboratory tests, 10 minutes was determined to be a sufficient time to let the tubing and analyzer purge any previous sample: there were no detectable temporal concentration changes greater than 1% of full-scale analyzer range. After 10 minutes, the appropriate ammonia and air mixture was formed using mass flow controllers. This ratio (inlet concentration of ammonia) was set by the user selection of concentration in each trial. This concentration flowed for 60 minutes for a given tubing material, length, and temperature. After 60 minutes, the flow returned to 100% zero grade air to test for desorption. The desorption sequence lasted for 20 minutes, giving the residual ammonia sufficient time to be removed from the tubing and analyzer (less than 1% full scale range concentration remaining). After 90 minutes the tubing was removed, the minimum amount of tubing required to operate the system (the calibration system in Appendix A.4) was reconnected, and the same inlet concentration was drawn through the machine. The resultant concentration was the target concentration: slight variations between the target concentration and ideal concentration existed because of small inaccuracies in the experimental equipment. The difference between the outlet concentration and the target concentration (C_{Diff}) was used to determine the adsorption of ammonia onto each type of tubing being tested. After the trial was completed, the appropriate physical factors (length, temperature, program concentration) were modified for the next trial. The software was reset, and the next experiment was started. A software program was developed to record the information from the analyzer using the LabVIEW hardware and software. This program (Appendix A.8) updated and recorded data every five seconds, twice the update rate of the analyzer and twelve times faster than the analyzer's own data logging system. The faster update rate ensured that every point from the analyzer was recorded. The five second data was averaged over one minute to remove incidence points and voltage noise. In addition to the ammonia concentration, the logging program stored the date, time, ammonia flow rate, and air flow rate.

In these experiments the temperature inside the tubing was determined by using stainless steel temperature probes inserted into the tubing exiting from the incubator. Warm air was drawn through the bottom of an incubator and across a heating element. The air was then passed across the different lengths of tubing (creating small differences in temperature due to residence times), warming the interior mixture. After determining the internal temperature and respective incubator setting, the temperature controls could be accurately described. An Onset Communications Datalogger (Bourne, Massachusetts) was used to record the temperature information as well as the time required to attain each temperature, and BoxCar 4 (Onset Communications) software was used to read the temperatures from the data loggers.

A randomized treatment experiment was designed to test four different treatments without bias. The treatments (variables) are outlined in Table 5 below.

Table 5. Ammonia Adsorption Variables Tested.

Treatment	**Description of Values**					
Material	Teflon					
Temperature (C)	26.67	37.78				
Length (m)	15.24	45.72				
Inlet Concentration (PPM)	2	5	10	15	25	35
Treatment	**Description**					
Material	LDPE					
Temperature (C)	26.67	37.78				
Length (m)	15.24	45.72				
Inlet Concentration (PPM)	5	15				

Teflon was tested for six different concentrations, while LDPE was tested for two different concentrations. Extra concentrations were used to model the Teflon over a larger range, as it is used to convey ammonia more frequently (Kosmulski, 2001; Davidson, 1979). The temperatures tested in each experiment are the temperatures at the inlet of the analyzer, not the temperature at the source (the mass flow controllers). The design and sequence of the entire randomized experiment is located in Appendix A.9.

Results and Discussion

Ammonia Adsorption

The experimental system response to the adsorption of ammonia is explained and discussed in Appendix A.10. This response includes the delayed reaction of the analyzer to the ammonia present due to the lengths of tubing used and the innate time requirements for the analyzer to register full scale readings. This delayed response was factored into the data analysis, and only the sixty minutes that the analyzer actually measured the full scale outlet concentration was used to determine the overall average for each experiment.

The concentration of ammonia that was created by the mass flow controllers was determined at the end of each experiment. Small fluctuations in concentration occurred due to the accuracy of the mass flow controllers and analyzer. The average difference in ideal (set by user) and actual (measured by analyzer) inlet concentration was 0.06 PPM with a standard deviation of 0.44 PPM (n=96). The difference between the measured inlet and outlet concentration was the ammonia adsorbed onto the tubing during the experiment. After the entire experimental design was completed, the 96 individual trials were analyzed.

Each data set was averaged over a one minute time period to smooth the irregularities in the data due to minute MFC fluctuations and voltage surges. This value was more accurate than the TEI logging software, as it was time averaged over the entire one minute measurement span. Once the moving average was created, the three repetitions for each treatment were compared and averaged. The outlet and inlet concentrations from the experiment are located in Appendix A.11. The entire collection of data from the 96 experiments is located in Appendix C.

The next statistical analysis performed compared the different materials used in the experiment. There were 24 experiments performed with identical treatments. These experiments were additionally analyzed together to determine what affect, if any, the tubing material has on the adsorption of ammonia. The simple one-factor ANOVA table for this analysis is included in Appendix A.12. From the table, adsorption of ammonia was significantly different (α=0.01) for Teflon and LDPE, with Teflon being significantly greater at reducing adsorption.

Once the significant treatments were determined for the different sets of tests, Fishers least significant difference (LSD) test was used to explore the differences among treatment means. The entire LSD table for each significantly different treatment mean is outlined in Table 6. Table 6 also displays the average $\%_{Diff}$ for each set of treatments from the experimental design. $\%_{Diff}$ is defined as the actual inlet minus outlet concentration divided by the actual inlet concentration (expressed as a percentage). The significant differences between each treatment mean are shown as subscripts. The different sample sizes for each treatment set are also outlined.

Table 6. Effect of Inlet Concentration, Temperature, Length, and Material on Ammonia Adsorption.

	Inlet Concentration Nominal PPM	Mean† $\%_{Diff}$	Length m (ft)	Mean $\%_{Diff}$	Temperature C (F)	Mean % Difference	Material	Mean $\%_{Diff}$
Teflon	2[1]	50.57[a*]	15.55 (50)[2]	14.20[a]	25.37 (80)[2]	12.92[a]		
	5	12.23[b]	46.63 (150)	14.42[a]	37.13 (100)	15.69[b]		
	10	9.50[c]						
	15	9.05[c]						
	25	2.25[d]						
	35	2.24[d]						
LDPE	5[1]	24.79[a]	14.78 (50)[1]	18.38[a]	25.37 (80)[1]	18.33[a]		
	15	18.57[b]	45.26 (150)	24.98[b]	37.13 (100)	25.03[b]		
Teflon vs. LDPE							Teflon[3]	10.64[a]
							LDPE	21.68[b]

[1]n=12 per treatment mean for Teflon concentration, LDPE concentration, LDPE length, and LDPE Temperature
[2]n=36 per treatment for Teflon length and Teflon temperature
[3]n=24 per treatment for Teflon vs. LDPE
† $\%_{Diff}$ defined as actual inlet – outlet concentration divided by actual inlet concentration * 100%
*Mean $\%_{Diff}$ values in columns followed by different letters are different at a 5% level

Table 6 displays the average percent difference ($\%_{Diff}$) of inlet and outlet concentration for each variable tested. Fisher's least significant difference (LSD) test was used to test the difference between the individual treatment variables. For LDPE, an inlet concentration of 5 PPM had significantly greater percent loss from adsorption than an inlet concentration of 15 PPM at α=0.05 (and at α=0.01). An increase in temperature for LDPE over the range of values tested showed a significant increase in $\%_{Diff}$. An increase in LDPE tubing length also showed a significant increase in $\%_{Diff}$ over the range of values tested. For Teflon, as nominal inlet concentration increased, $\%_{Diff}$ decreased significantly in each case, with the only exceptions being 15 and 35 PPM, which did not decrease significantly over 10 and 25 PPM, respectively. As with LDPE, an increase in temperature for Teflon over the range tested showed a significant increase in $\%_{Diff}$. However, an increase in length did not increase $\%_{Diff}$ significantly over the range tested. For comparison of materials, the LDPE $\%_{Diff}$ concentration was significantly greater than Teflon, or LDPE adsorbed more ammonia than Teflon at α=0.05 (and also at α=0.01). All other treatments did not have significant treatment differences.

The losses for each material showed an inverse relationship between inlet concentration and percent of ammonia adsorbed on the polymer surface. For both materials the higher temperature (38 ^{o}C) resulted in a significantly higher adsorption of ammonia. Different tubing lengths resulted in significantly different adsorption results in LDPE tubing only.

With knowledge of the concentration of ammonia lost between the tubing inlet and outlet, as well as the flow rate maintained in the system, the number of molecules of ammonia that were adsorbed at steady state were estimated for each experiment. The surface area of each type of tubing was known, so the percentage of the surface area of each material that had adsorbed ammonia was estimated. For Teflon tubing, ammonia occupied an average of 2.3% of the surface area of the tubing (±2%), whereas ammonia occupied an average of 5.5% of the surface area of LDPE tubing (±3.8%). These results agree with Table 6, which shows that Teflon has a higher resistance to adsorption than LDPE. In each case the shorter tubing length had a surface area occupied with approximately a three fold increase in number of ammonia molecules per unit surface area.

Regression Modeling

The dependent variable in these experiments was the difference between inlet and outlet ammonia concentrations (denoted C_{Diff} – the quantity of ammonia adsorbed). For each tubing material used, the treatments from the experiments were statistically analyzed to determine what affects the treatments had on C_{Diff}. In addition, any treatment interactions were explored to determine if additional modeling or analysis was required. For Teflon there were a total of 72 different C_{Diff} values, and for LDPE there were 24 C_{Diff} values. The difference in number of experiments occurred because of the difference in total number of ammonia concentrations being measured. The experimental design allowed for a three factor factorial statistical analysis of the mean effects and interactions. The complete analysis of variance (ANOVA) tables for both Teflon and LDPE are located in Appendix A.13. Because the two materials were never used in the same experiments, there were no possible interactions between each set of treatments, and thus each material was analyzed separately. From the Teflon ANOVA the following treatments had effects on C_{Diff} at α=0.05: concentration, temperature, and interactions between concentration and length, concentration and temperature. For LDPE only the mean effects (concentration, temperature, and length) had statistical significance at α=0.05.

A predictive equation was developed to allow for estimation of the amount of ammonia lost during use of polymer tubing for fluid conveyance. For each material, the first model developed used each variable found to be significant at α=0.05. From the output of this model descriptive statistics were used to determine model adequacy and individual regressor significance. The final treatments used to model the adsorption of ammonia from the two polymers were different. For Teflon, the independent variables used were outlet concentration and temperature (Equation 21). For LDPE the independent variables used are outlet concentration, temperature, and tubing length (Equation 22).

$$C_{Teflon}=0.994\cdot C_{out}+0.031\cdot T \qquad (21)$$

$$C_{LDPE}=-1.791+1.193\cdot C_{out}+0.058\cdot T+0.019\cdot L \qquad (22)$$

where:

C_{Source}= Concentration from source of ammonia (PPM)

T= Temperature of fluid stream (^{o}C)

L= Tubing length (meters)

The entire set of regression confidence intervals, statistics, and analysis of variance are detailed in Appendix A.12-A.14. For both materials the predictive equations are only applicable in the tested ranges of temperature (measured at ammonia analyzer), concentration, and tubing length.

Fishers LSD determined that most of the individual treatment means differ for the factorial experiment (α=0.05). This stems from the relatively small mean square error (MSE) for the treatments. For Teflon, there was an inverse relationship between inlet concentration and percent concentration difference. For LDPE there appeared to be a trend of higher inlet concentration yielding higher adsorption, but this cannot be verified through any other concentrations. For both materials it appeared as though higher temperatures caused a higher loss of ammonia through adsorption, although only LDPE showed a significant relationship between tubing length and adsorption losses. Comparing materials clearly showed that Teflon has a higher resistance to ammonia adsorption than LDPE (α<0.001). An experimental trend from the output is displayed in Figure 8 below. In this graph the inlet concentration is graphed against the percentage of the inlet concentration lost due to adsorption for Teflon. If a sufficiently high concentration is input into the tubing then all of the adsorption sites are quickly filled by ammonia. The remaining concentration then passes through the tubing without any further adsorption. On the other end of the spectrum, if a sufficiently low concentration of ammonia is input into the tubing then a substantial amount of the ammonia is lost to adsorption sites. In this case almost no ammonia will remain unbound to pass through the tubing. At some time in the experiment all of the adsorption sites will be filled and the remaining low concentration will pass through the tubing, causing an adsorption 'wave'. In effect, both ends of the concentration scale have the same effect; it is only the large variation in timing that separates the two. Over the course of a 60 minute experiment the time differences may be too great to notice.

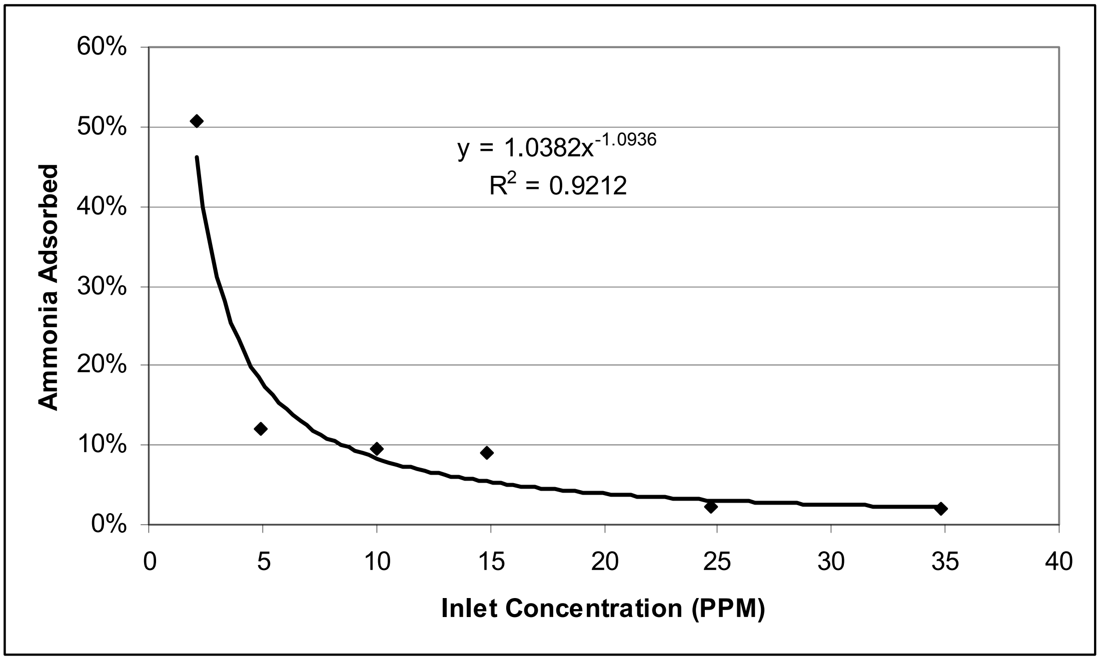


Figure 8. Relationship Between Ammonia Adsorption and Ammonia Concentration on Teflon Tubing.

As mentioned, LDPE adsorbs more ammonia than Teflon. This extra adsorption, surface area phenomena, can be seen by the direct modeling of the surface area (length) of tubing. Teflon, a more resistant material, does not show a dependence on tubing length to predict ammonia adsorption. The most significant treatment for Teflon is temperature. This does not mean that these treatments do not have some affect on adsorption – they are merely not necessary to model the adsorption at a 95% confidence level. As an example, tubing length was determined to not be a statistically significant treatment for Teflon by using an f-test. This was statistically verified by the large p-value (>0.10) of tubing length when attempting a t-test to test tubing length regressor adequacy.

It is important to mention the difficulties with extrapolation, and in some instances interpolation, from a model in three-space. As an example, if Equation 20 is used and the measured concentration is 20 PPM and the ambient temperature is ten degrees Celsius, the source concentration will be 19.97 PPM: lower than the measured concentration. This is physically impossible, but a circumstance when using the equation for extrapolation. In this case the lower bound on temperature is approximately 27 degrees Celsius. It is also important to note that only two temperatures were used in this experimental design. This lack of data stems from the exponential increase in time and materials costs associated with adding more treatments to a factorial experiment. With only two temperatures the relationship interpolated between the two points cannot be known. It is assumed that over this range the relationship is approximately linear. This assumption has not been experimentally verified.

Conclusions and Future Research

The adsorption of ammonia onto Teflon and LDPE is controlled by different treatment factors for each material. For Teflon it appears that temperature and inlet concentration are the significant treatments that explain ammonia adsorption (α=0.05). For LDPE it appears as though all three treatments (tubing length, temperature, and inlet concentration) are important for the description of ammonia adsorption (α=0.05). The final predictive equations for both materials are displayed in Equations 20 and 21. The associated t-tests to test the model, treatments, and regression are located in Appendix A.14. Both models and both sets of variables are significant above a 99.9% confidence level, and both have adjusted r^2 values above 0.99.

This experiment assumed that the changes in ammonia adsorption were a linear function of the different variables tested. This was not necessarily true, but under the small range of values encountered in the field coupled with limited time, this assumption was determined to be valid. Extrapolation of this data has not been physically verified, and deserves attention to strengthen the model and investigate other predictors. Other factors such as pressure, electrical charge, relative humidity, and flow rate may play a role in determining the true variables that affect the adsorption of ammonia. By using a complete factorial experiment the number of trials required is exponentially related to the number of factors being tested, so care should be exercised when selecting additional factors to test. Future work should continue in this research to extend the knowledge base for ammonia adsorption.

The absorption of ammonia has been studied and characterized for over 50 years (Hobson and Chapman, 1972). The interactions of adsorption and absorption under laboratory and field conditions deserve attention. In cases where ammonia containing samples are collected over a liquid surface, relative humidity will become an issue. The addition of relative humidity into the factorial experiment may have the potential to more accurately predict ammonia losses.

There exists a physical limit of inlet concentration above which no adsorption will be present. In initial tests during this study the full-scale concentration of the ammonia cylinder was conveyed directly into the analyzer without any dilution for each set of treatments (material, length, and temperature). This input concentration of 46.2 PPM was also the exact concentration that the analyzer measured: there was no detectable ammonia adsorption. This value was not used as an input into any model because it is unlikely that this value is the minimum concentration that limits adsorption. Research should be focused on determining this concentration based on temperature, length, and choice of materials. The addition of that boundary condition will not only allow for a larger range of interpolation of the current model, but will also lessen the errors of the current mathematical model by adding more physical constraints.

CHAPTER IV

PRELIMINARY AMMONIA EMISSION FACTOR DEVELOPMENT FOR A CENTRAL TEXAS DAIRY

Introduction

Annual production of ammonia from agricultural sources is estimated to be 43,800 metric tons per year, 84% of which is attributed to livestock production (Battye et al., 1994). This ammonia is a colorless gas that is a principle contributor to small particle formation and acidification of the environment. To determine the amount of ammonia that is being emitted from a facility an emission factor is typically required. This factor has units that allow a user to estimate the total amount of the pollutant from inputs specific to the facility in question. Although this factor is only an estimate, it is important that it be representative of the facility and area for which it is being used. Research for dairy ammonia emissions has been completed for different climates and areas in Europe and eastern United States (Asman, 1992; Battye et al., 1994; Van der Hoek, 1991). Dairy nutrition, husbandry, and waste handling practices vary from location to location based on a number of factors such as land availability and proximity to populated areas. These variations lead to variations in husbandry and waste handling procedures, which have a direct affect on the amount of ammonia that is emitted into the atmosphere (Erisman, 1989).

The Environmental Protection Agency (EPA) implemented particulate matter less than 2.5 micron ($PM_{2.5}$) standards in 1997 in response to health concerns. The Clean Air Act revisions in 1997 established a timeline for compliance with these new $PM_{2.5}$ standards, recognizing that a lead time would be required to meet the new standards. The EPA is currently monitoring and identifying $PM_{2.5}$ sources. Areas not in compliance with the 1997 standards will be identified in 2002-2005, and states not in compliance will then have up to 10 years to implement their plans. Research (Walker, 2000) has shown a direct link to ammonia volatilization and small particle formation of secondary $PM_{2.5}$ from ammonium ions. Therefore, the formation of ammonia from dairy operations plays a role in secondary

$PM_{2.5}$ formation. Atmospheric ammonia that reacts with acids to convert into aerosols is estimated to comprise a majority of secondary $PM_{2.5}$ particles (Ueda et al, 1999; Singh et al, 2001).

Ammonia is a colorless, corrosive, alkaline gas with an extremely pungent odor that can be detected in concentrations down to less than twenty parts per million (PPM) (Holland, 2001). Ammonia is very soluble in water, and is a good solvent. Ammonia exists in the atmosphere in the gas phase, and is subject to gas-phase reaction with hydroxyl (^{-}OH) radicals, reaction with gaseous nitric acid (to form particulate ammonium nitrate), and with aerosols to form ammonium salts (Singh, et al, 2001). Ammonia that does not react in the atmosphere can adsorb to water molecules and re-enter the local environment in the form of acid rain, disrupting the pH of biological systems (Kangas and Sanna, 2001). Atmospheric ammonia deposition alters the species composition and biodiversity of ecosystems and causes acidification and eutrophication of soils as well as leaching of nitrogen to surface and ground waters. The transport of nitrogen to rivers and seas causes eutrophication, visible predominantly as algae formation. Acidifying deposition from ammonium reduces pH of soils and waters affected and causes leaching of aluminum, threatening the vitality of forests and fish stocks (Kangas and Sanna, 2001).

There are three broad ways in which an ammonia emission factor may be estimated. The first is by a nitrogen mass balance. A nitrogen mass balance uses physical nitrogen data collected from feed and waste, a dairy survey completed by the owner, and nitrogen concentration standards to estimate the amount of ammonia available for release. This balance predicts ammonia production and volatilization rates from input nitrogen in feed from chemical equations that govern the biological processes. Mass balances give theoretical limits on production, but these limits have a strong relationship to the physical nature of the system, the husbandry of the dairy, and the waste management practices involved in the dairy (Asman, 1992). The second emission factor estimation process is through direct measurement. In direct measurement the concentration of ammonia is measured directly from the source and analyzed. From this concentration an emission flux can be determined that is used to create the final emission factor. Examples of direct measurement systems include isolation flux chambers and wind tunnels. Direct measurement systems may yield real time or time averaged results based on the system being implemented. The final estimation types are indirect measurements, such as meteorological models, gradient techniques, or integrated spatial mass balances. In most indirect measurement systems an optical instrument such as an open path laser (i.e. long-path Fourier Transform Infrared (FTIR) Spectrometer) is used in conjunction with several reflecting mirrors to detect ammonia present at low levels in the atmosphere, and complex mathematical models are used to predict where the ammonia source originated. Once this source is located, a flux can be determined and the emission factor work proceeds as in direct measurements. Typically the source is located and quantified, and then a selected method is used (gradient, flux density, or energy) to estimate the time dependent transport of ammonia and trace it back to its assumed origin. Background emissions are often also collected to aid in the location of the emission source.

The efforts of this research were focused on using a direct measurement approach. Direct measurements allow for the most practical and physical method to determine the actual ammonia concentration from the source (EPA, 2002). Specifically, an isolation flux chamber was used to measure ammonia concentrations. This research developed the protocol for operating the flux chamber at a dairy as well as protocol for sample reporting and emission factor development. As an added check to the emission factor that will be created using this protocol, a mass balance of nitrogen will be conducted as a theoretical limit of ammonia production. This mass balance will correspond more directly to a representative mass balance for a Texas dairy. Nitrogen content in feed is variable based on production level, access to raw materials, and nutritional goals that change for different regions and times. This two part approach creates a system of checks and balances for the total ammonia inventory at the dairy. Future work in this area will focus more sampling of different dairies at different times throughout the year. This future work will refine the estimate developed in this research.

Objectives

Ammonia is precursor to $PM_{2.5}$ and a primary neutralizing gas that is emitted from agricultural facilities. To estimate and track the amount of ammonia, an emission factor is required. This factor allows an individual to estimate the amount of a pollutant given specific inputs that describe the system. Texas has not developed an ammonia emission factor for dairies, which have different climates, waste management practices, and animal husbandries than previous researchers' focus. The overall goal for this research is to develop a sampling protocol for measuring ammonia at dairies. To realize this overall goal, sub objectives have been carried out.

1. To develop an ammonia flux measurement protocol using the isolation flux chamber.
2. To complete a nitrogen mass balance for the feed and animal wastes at a Texas dairy.
3. To develop an emission factor for ammonia for a central Texas dairy during summer and winter conditions.

Methods and Materials

Facilities Description

A dairy in central Texas was selected for ammonia emission measurement protocol development. This dairy was a hybrid dairy, or a dairy with both open lots and free stalls, which is common in the state of Texas. A schematic of the facilities is presented in Figure 9. This aerial photograph is a series of Digital Orthophoto Quarter Quadrangles (DOQQ) files taken January 9, 1995 for the Texas Geographic Information Council (Texas Geographic Information Council, 1998). A DOQQ is a digital mapping product that combines the geometric qualities of a map with the detail of an aerial photograph. DOQQs are derived from scanned aerial photos that have been corrected so that image distortion caused by perspective, camera tilt, and terrain relief are removed. At the time of the photographs, the dairy had not yet implemented some of the husbandry changes. Those unit processes that are not included on the original map are superimposed on Figure 9 to represent a more recent design.

The dairy houses 1840 lactating cows and 250 dry cows. Cows were housed in two predominant ways: open lots and free stalls. The higher milk producing cows were generally housed in free stalls. These shelters contain concrete pads with feed lanes and loafing areas. The open lot was generally comprised only of a bare earth plot of land with centralized feeding and watering areas as well as free standing shelters for relief from severe elements, and is reserved for lower producing cows.

The free stalls were flushed four times per day: 7am, 1pm, 7pm, and 1am. At each flushing, a large volume of water was introduced at the point of highest head in the system (northwest). The average Texas dairy uses 50 gallons of water per cow per day to flush the free stalls (Sweeten, et al, 1983). The water traveled from northwest to southeast on the concrete pad and emptied into open channels, which lead to a mixing tank. There are three free stalls located on this dairy, and each is flushed in series from north to south. Within each barn a one-hour cycle of flushing began from the north and continued from each alley after 15 minutes of flushing. After the volume of water in the sedimentation basin had reached a pre-set height, a bobber system activated an agitator. This agitator mixed the effluent and pumped it onto a mechanical solids separator. The removed solids were piled nearby through a conveyor system while the remaining effluent entered the lagoon system. The first lagoon accepted effluent from the three free stalls as well as two open lots. The lagoon also flowed into a hybrid second lagoon through a controlled piping outlet. This second lagoon also accepted runoff from two other open lots. The second lagoon supernatant was used as irrigation effluent for several center pivot irrigators on site.

Scraped solids from the open lots and the solids that were removed from the screening system were formed into windrows in a separate composting area on the dairy (Figure 9). The compost was typically mechanically turned every ten days, although a formal schedule was not kept. The composted separated solids were used as bedding for the free stall barns.

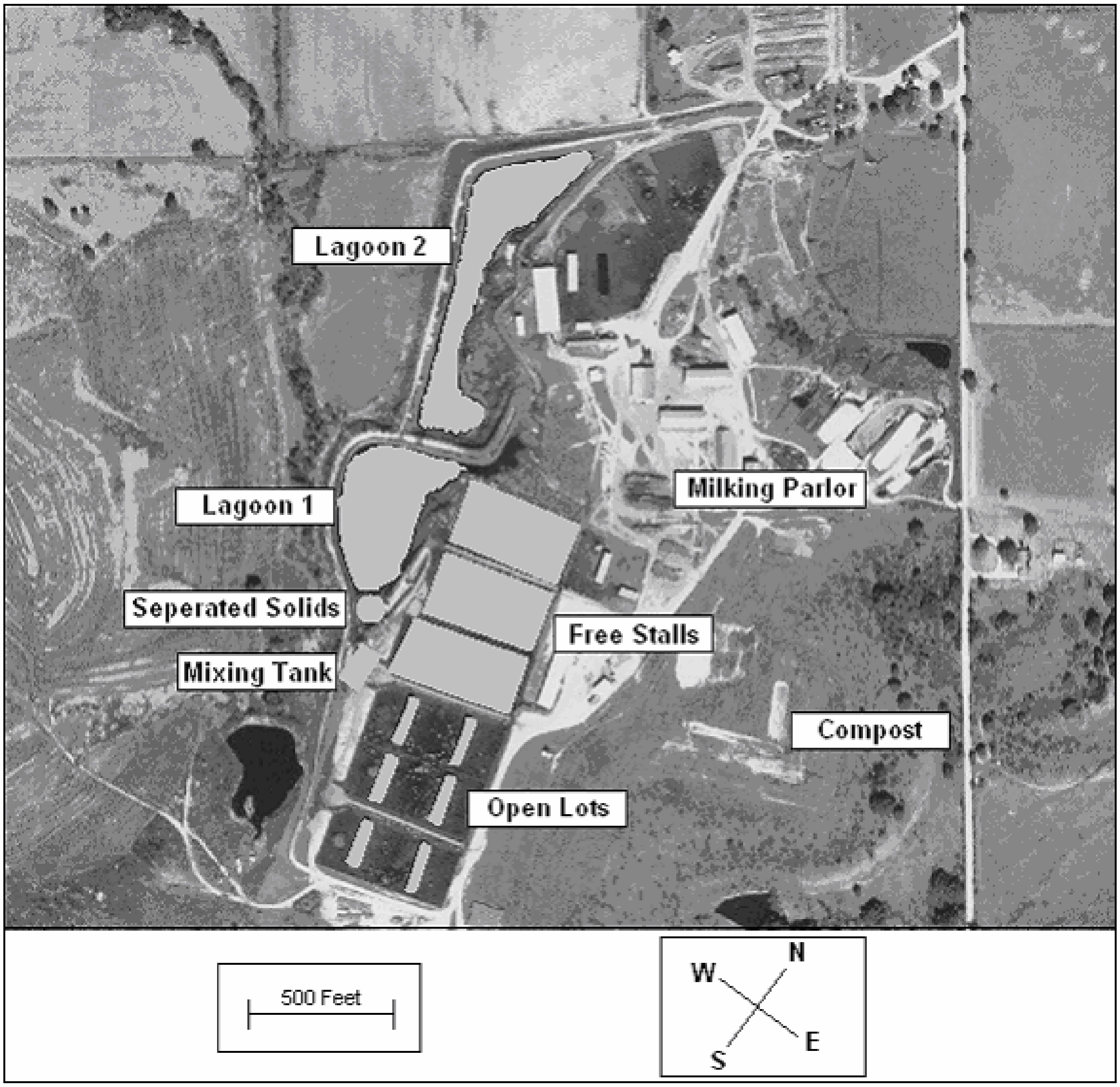


Figure 9. Aerial Photograph of Dairy in Comanche County, Texas.

The area of the free stalls, open lots, separated solids, mixing tank, lagoon one, lagoon two, and composting was measured to estimate the total amount of ammonia emitted from the dairy. ArcVIEW 3.2 (Environmental Systems Research Institute. Redlands, California) was used to estimate the area of each lagoon by digitizing the lagoon shape into a shape file and then using the built-in area calculation utility. The other waste processes were measured using a measuring wheel. The free stall area was measured with the digitizing tool and the measuring wheel as a check for accuracy and scale.

To determine a direct method emission factor for ammonia the emission concentration must be determined. This is the concentration of ammonia that is emitted from the ground level area source (GLAS). Once this concentration is determined an emission rate can be calculated. The method to be used to detect the ammonia concentration in this research was chemiluminescence (Thermo Environmental Incorporated (TEI) Model 17C, Boston, Massachusetts). Chemiluminescence analyzers allow for real time determination of gaseous air pollutants. The analyzer utilized the reaction of nitric oxide (NO) with ozone (O_3) to create nitrogen dioxide (NO_2) and oxygen (O_2). See Appendix A.1 for full documentation of analyzer operation.

Isolation Flux Chamber Sampling Protocol

The direct measurement technique utilized in this research involves isolation flux chambers. Isolation flux chambers have been used by engineers and soil scientists since 1982 (Eklund, 1990). The basic design of the flux chamber includes a hemispherical top and a cylindrical skirt. Odotech Incorporated supplied the hemispherical top for use in this research (Odotech. Montreal, Canada). Flow rates entering and exiting the chamber are defined following the procedures of Gholson (1985) and Eklund (1990) through design work for the United States Environmental Protection Agency. In this design contaminant free (zero grade) sweep air was inserted into the chamber at a rate of ten liters per minute. This air removes the ambient air located above the surface to be tested. In experiments (Eklund 1990) four residence times were used to verify that the system has been isolated from its initial environment.

The skirt was available in acrylic or could be fabricated in different materials, the most durable typically being stainless steel (used in this research). The two pieces were typically joined by a set of wing nuts and sealed using a gasket (Figure 10). The dome contained four symmetrical holes with stainless steel fittings. These holes helped to maintain an open system with the atmosphere. A tubing inlet located at one of the stainless steel fittings allowed for a sweep flow of air into the chamber. A fitting on the top of the hemisphere allowed for the pollutant stream to be conveyed to a measurement device. The inlet tubing was perforated to allow air flow to enter radially at all points inside the chamber. The flow rate used created a slightly positive pressure inside the control volume, which isolates the chamber from the surroundings.

The chamber (Figure 10) used in this research has a diameter (a) of 49.5 centimeters and a cylinder height (b) of 22.9 centimeters. The dome (c) has a height of 16.5 centimeters. Given these dimensions and the incoming flow rate, it requires slightly more than 25 minutes to achieve four residence times (Equation 23).

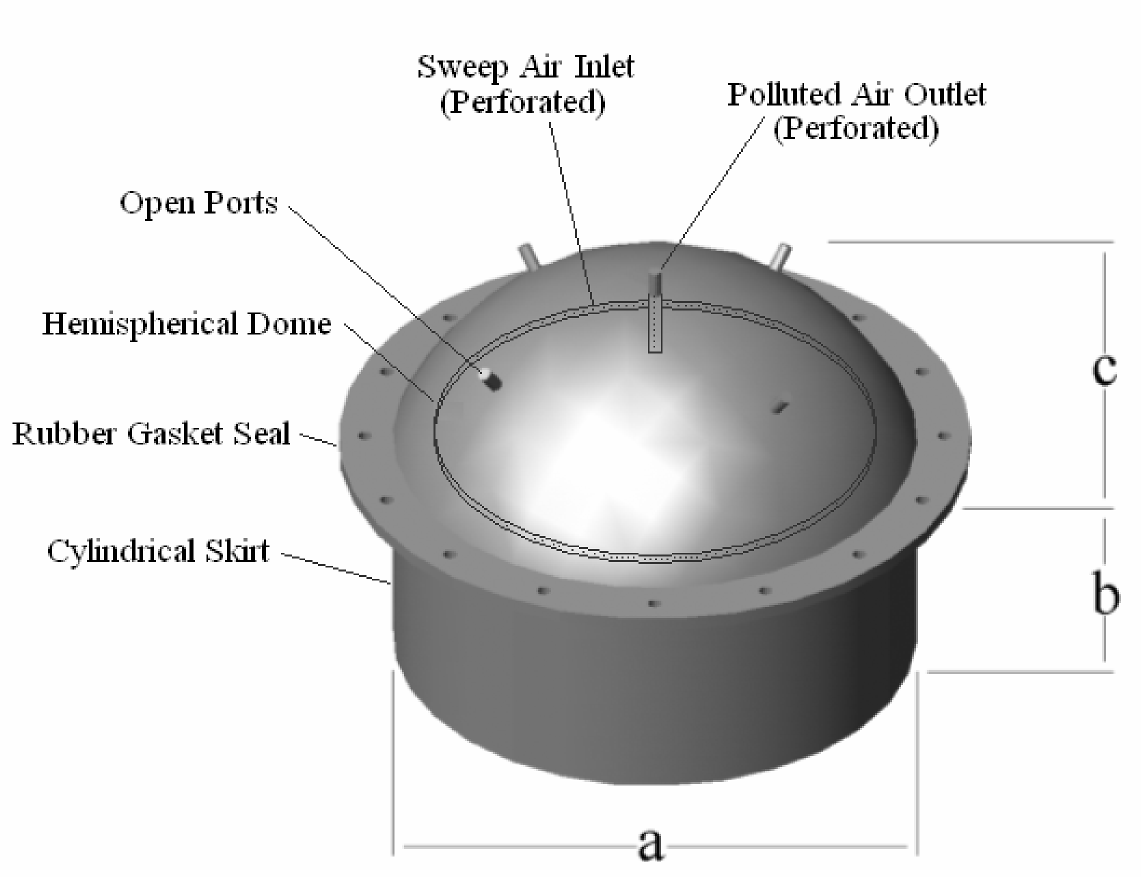


Figure 10. Flux Chamber Schematic.

$$t = 4 \cdot \frac{v}{\dot{Q}} = \frac{4 \cdot \left(\frac{\pi}{4} d^2 h + \frac{\pi}{12} d^3 \right)}{10 \frac{l}{\min}} = \frac{4 \cdot \left(\frac{\pi}{4} (49.5^2 \cdot 16.5) + \frac{\pi}{12} (49.5^3) \right) cm^3}{10 \frac{l}{\min} \cdot \frac{1000 \text{ cm}^3}{1\, l}} = 25.4 \text{ min} \qquad (23)$$

where:

t = time for four residence times in chamber

v = volume of chamber (cubic centimeters)

d = chamber diameter (centimeters)

h = chamber height (centimeters)

$\dot{Q}$ = flow rate into chamber (liters per minute)

A time of approximately 25 minutes was required to achieve four residence times with the given flux chamber geometry. Once the control volume in the chamber was purged, the flow rate was reduced to five liters per minute. Experimental results (Gholson, 1989) determined that a flow rate of five liters per minute resulted in the most precise and accurate measurements from an area source. This new flow rate was maintained for an additional 30 minutes. After one hour from initiating purging, the experiment was complete.

The surface wind speed direction over the area source is not well defined, but using the geometry of the chamber and the incoming flow rates, the wind speed was approximately 1.5 miles per hour (Eklund, 1992). This wind speed and resulting turbulence have an affect on the emission of ammonia from the surface being tested (Arago, 2001; EPA, 2002). Wind speed affects the equilibrium between total ammonia nitrogen in the area source and the gas-phase ammonia present in the ambient air by altering the gradient, affecting the flux. The wind speed is well characterized, but the direction is not because of the radial perforations in the inlet tubing. A significant amount of research has been conducted to standardize the flow rates, cross sectional areas, and volumes of flux chambers (Eklund, 1992). Chambers used in this research also had an excellent potential to compare unit processes within the same facility, as the GLAS was isolated identically in each experiment. A small positive pressure existed inside the chamber, caused by forcing more air into the chamber than was removed. The remaining air escaped through the holes that surround the chamber dome. A seal with the ground was required to keep this positive pressure and avoid the loss of the seal.

Setup and Equipment

The ammonia analyzer required 90 minutes to stabilize, allowing the internal temperatures of the converters and analyzers to equilibrate to proper operating levels to ensuring accurate measurements. Since the entire laboratory used in this research was mobile, a 7000 watt generator was used to power the analyzers and auxiliary equipment such as pumps, computers, and mass flow controllers. An uninterruptible power supply (UPS) system was used to regulate the voltage from the generator to the analyzer to provide for constant power during normal operation and during generator power failures. While the analyzer was running, the auxiliary equipment was operated. An air conditioner was used to prevent the temperature inside the mobile laboratory from exceeding 90 degrees Fahrenheit, within the operating conditions of the TEI analyzer. The mass flow controllers used in the control of the sweep air and polluted air must run for 15 minutes before accurate readings can be expected. This time requirement allowed the internal temperatures to equilibrate, which allowed the flow controller to use the accurate thermodynamic properties of the gas stream to measure the flow. The controllers and computer rested on a fabricated stainless steel table that was attached to the side of the trailer to ensure that the mass flow controllers were parallel to the ground. Each mass flow controller was tilt dependent, and to ensure accuracy the controllers were calibrated and operated in the same position.

The chamber was attached to the analyzer with 0.635 centimeter (¼ inch) inside diameter perfluoroalkoxy (PFA) polytetrafluoroethylene (PTFE, or Teflon) and low density polyethylene (LDPE) tubing. The tubing varied from fifteen to forty-five meters in length based on the accessibility to the process being measured. LDPE tubing carried the zero grade sweep air from the laboratory to the isolation flux chamber. Teflon tubing was used to carry the pollutant stream from the chamber back into the mobile laboratory for analysis. The sweep air introduced to the system was by definition a purified air, and thus did not need to meet the more stringent quality standards of Teflon. The air returning from the chamber had some concentration of ammonia, and thus required a higher chemical resistance to ammonia adsorption to ensure an accurate measurement. Teflon has a high chemical resistance and is used for the wetted parts throughout the analyzer.

A steel dolly (Appendix B.1) was fabricated to transport the chambers both on long term trips to sampling sights and also to move the chambers throughout the facility being sampled. To measure ammonia concentrations from liquid surfaces (lagoons and flush water mixing tanks) a floating pontoon system (Appendix B.2) was developed. This allowed the chamber to be moved to the desired location and then lowered onto the exact area. By allowing the chamber to move above the surface of the liquid in transit the area source being measured was still isolated. The chamber rested on three pressurized air pistons. Once the chamber was in position a valve was turned to vent the pressurized air into the atmosphere, bleeding the line of pressure and lowering the chamber into position. A Teflon pump (KNF Model N840.3FTP Neuberger, Germany) was used to overcome the pressure drop through the Teflon tubing from the chamber and into the analyzer. The analyzer could not draw air farther than ten feet, so an auxiliary pump was used to draw from lengths of over 100 feet. The entire head of the pump (wetted parts) was comprised of Teflon.

Ammonia Sampling Procedure

A measurement protocol was established from a refined procedure developed during a summer sampling trip. Once the necessary equipment was activated, the sampling process began. The fabricated flux chamber dolly was used to safely and quickly maneuver the chambers from the laboratory to the area source to be tested. Once the chamber was located near the source, corresponding tubing was attached to the chamber for conveyance of the pollutant stream to the analyzers as well as pollutant free air into the chamber. The inside of the trailer had static lines dedicated to the specific streams necessary to measure for ammonia. A schematic of the laboratory tubing is indicated in Figure 11 below. In the schematic, dashed lines indicate low density polyethylene and solid lines represent Teflon.

LabVIEW Software

Two software programs were developed to automate the process of ammonia concentration measurements. The first LabVIEW program automated the timing patterns required to make a flux chamber measurement (Appendix B.3). The software used the zero air mass flow controller (air MFC) to regulate 10 LPM of sweep air into the chamber for exactly thirty minutes. After thirty minutes the MFC changed to 5 LPM for 30 minutes. In addition, the incoming flow rate was a variable set by the user. In this experimentation, 2 LPM was removed from the chamber to ensure that the analyzer had sufficient flow with which to measure. The ammonia analyzer required a minimum of 0.6 liters per minute to properly operate, but the extra flow was used to ensure that the machine was sampling only pollutant air at atmospheric pressure – the remaining stream was vented outside the laboratory. The specific flow rates and durations were used following the sampling protocol developed by Gholson (1989) for the US EPA. In addition to the timing software, a logging program (Appendix A.8) was developed to record the ammonia concentration from the analyzer. By recording data more often than the analyzer can measure, no data was lost.

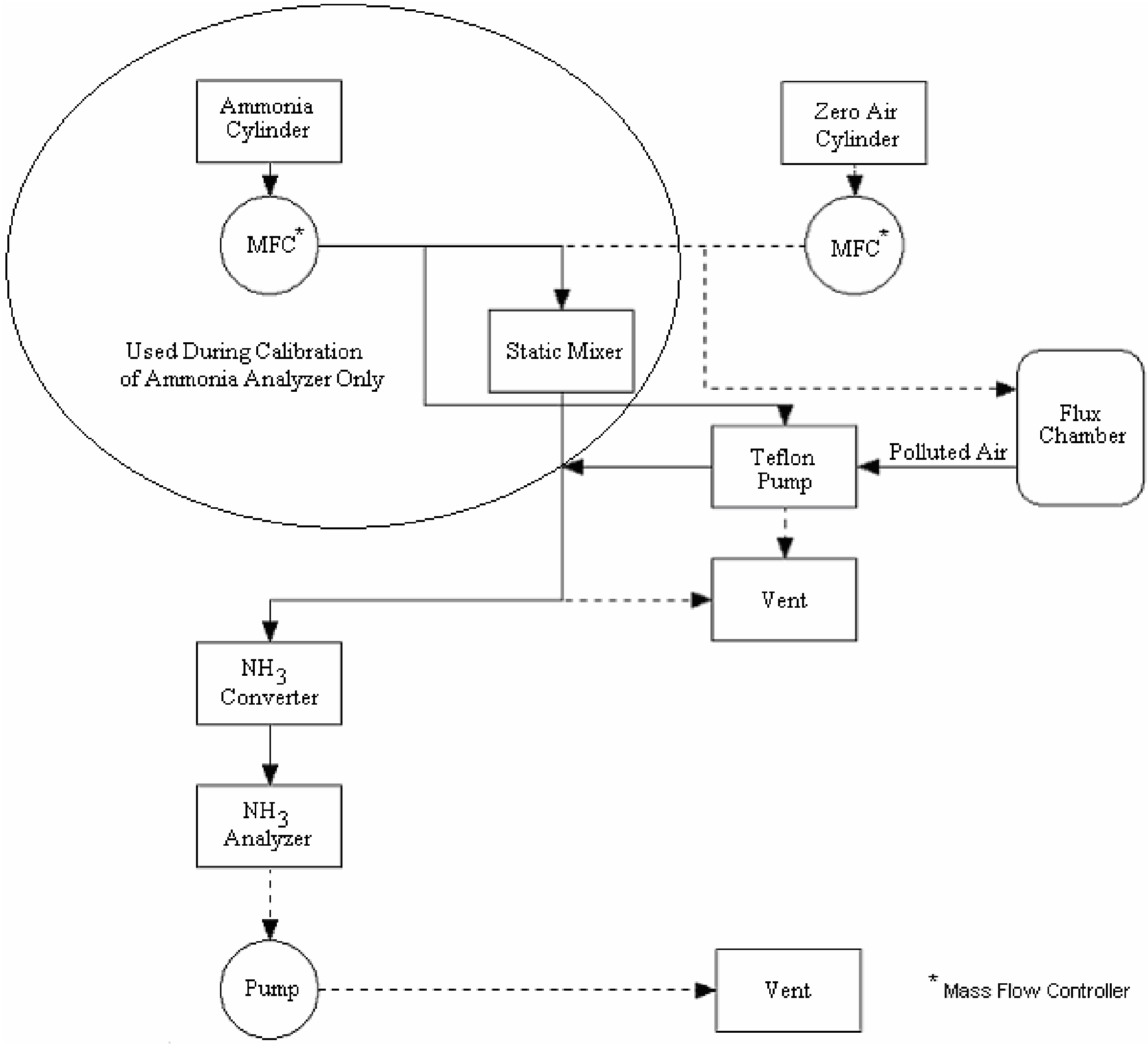


Figure 11. Laboratory Schematic.

It was important to be expeditious with the sampling procedure once the chamber had been placed in its position to measure the area source due to the nature of the flux chamber. Eklund (1992) concluded that the chamber was to be inserted no more than approximately seven centimeters below the surface of the GLAS, although research by Gholson et al. (1989) determined that penetration did not have an affect on concentration measurements. Over long periods of time (>6 hours), if the chamber was inserted too deep then it could isolate the column of material directly under the flux chamber, leading to possible errors associated with the isolated material reducing its emission. In this research two chambers were used: one with the same dimensions as Figure 10 and one that has a depth 7.6 centimeters greater. This chamber was used when the source being sampled required deeper chamber penetration due to unstable conditions, steep slopes, or porous materials. When this chamber was embedded to greater depth it still retained the same volume and thus the same geometric characteristics. The chamber isolated the environment directly surrounding the source being measured, and this isolation began as soon as the chamber was placed on the GLAS. If the chamber was subject to direct sunlight then a white sheet was used as a cover to shield the chamber from direct sunlight. Although the interior chamber temperature was not the same as the environment, the difference would be significantly magnified if direct sunlight was allowed to enter due to heat radiation.

The temperature and pressure of the GLAS were important factors needed to determine the actual emission rate of ammonia. One stainless steel temperature probe was inserted into one of the four empty annuluses (0.635 cm inside diameter) in the flux chamber dome. These probes, as well as a second probe to measure the surface temperature of the GLAS, were connected to a four channel datalogger (Onset Communications. Bourne, Massachusetts), an analog data logging device that was read using BoxCar Pro 4 software (Onset Communications). The datalogger also had two dedicated channels for ambient temperature (outside the chamber), as well as relative humidity and other ambient conditions. These data loggers allowed for real-time records of temperature that allowed for more accurate mass concentration calculations (Equation 22).

Once the respective tubing was attached, the software used to control the measurement was utilized. There were two mass flow controllers (MFCs) used when measuring ammonia: one controlled the amount of air that was delivered to the chamber and the other controlled the amount of polluted air that was transported from the chamber to the analyzer.

Once the measurement was completed, the chamber was removed and cleaned and the software was reset. The chamber was then placed on the next GLAS, the software programs were started, and the next measurement began. Hand-written concentrations as well as a system of written verifications ensured that data were not lost or corrupted.

The emission factor could be determined from the emission concentration, physical properties of the GLAS, flow rate used in the measurement, and total number of cattle present at the dairy (Equation 24). Equation 24 also has the constant conversion value of $1.536 \cdot 10^{-2}$ to allow for the units expressed in the variable definitions.

$$EF = 1.536 \cdot 10^{-2} \left(\frac{C \cdot P \cdot FR \cdot A}{n \cdot T} \right) \tag{24}$$

where:

EF = emission factor for ammonia (kilograms per thousand head per day)
C = emission concentration of ammonia (PPM)
P = atmospheric pressure (kilopascals)
FR = flow rate (liters per minute)
A = surface area of waste process (square meters)
n = number of cows on dairy
T = temperature of control volume (Kelvin)

It was necessary to determine these six variables to calculate this emission factor.

- The concentration of ammonia in PPM was determined using the TEI chemiluminescence analyzer as previously described.
- Using the logging software the actual flow rate from the mass flow controller into the chamber was known, and the average over the ammonia measurement period was used as the flow rate.
- The pressure was determined by using a standard barometric pressure recorder. It was assumed that the small increase in atmospheric pressure inside the chamber was negligible compared to the atmospheric pressure.
- To estimate the total area either ArcVIEW 3.2 (for each lagoon) or with a surveying wheel (all other unit processes) was used.
- The number of cows on the dairy was a relative constant.
- Stainless steel temperature probes were used to determine the temperature inside the flux chamber.

Compost Measurements

During summer conditions the compost was measured six times, of which three were before mechanical turning and three were after turning. During winter conditions three samples were taken from a windrow that did not show signs of recent turning. For each sampling trip a representative area was selected on the side of the windrow. The larger chamber was used to ensure that the chamber did not break its seal with the compost, or tip over due to the angle of repose.

Lagoon Measurements

Each lagoon was measured independently from several locations. For each lagoon the measurements began near the entrance of the effluent and moved downstream from this entrance. During summer, five measurements were taken at the first lagoon and four were taken at the second lagoon. During winter, six measurements were taken from each lagoon. A pontoon system, described earlier, was used for ammonia measurements from lagoon surfaces. The measurement locations are indicated in Figure 12. Using the area utility in ArcVIEW 3.2 the first lagoon had an estimated area of 14,356 square meters (m^2) [154,530 square feet, (ft^2)] and the second lagoon had an area of 15,510 m^2 [166,950 ft^2].

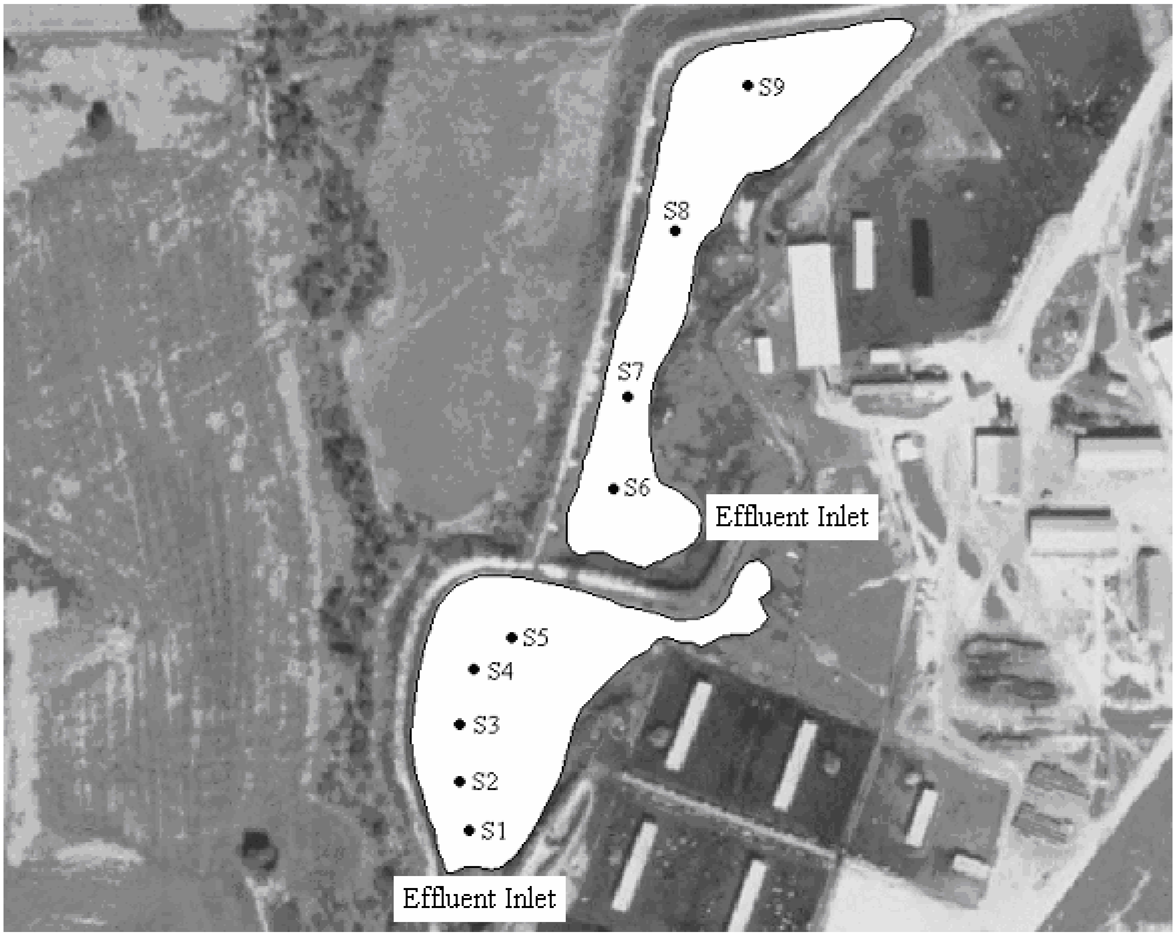


Figure 12. Aerial Photograph of Lagoons with Sampling Points Labeled.

Separated Solids Measurements

The daily amount of water required to adequately clean the manure from 1840 cows creates a large volume, approximately 348 cubic meters (Sweeten, 1983), of effluent that is screened for solids. This produces one to two conical piles of separated solids ranging from a height of three to six meters and a base with a diameter of 9 meters. The variability in size is a function of the frequency of loading trucks removing the solids as a component in the composting operation. Once a pile has reached six meters, or the approximate height of the conveyer, loading trucks begin removing solids from this cone and a new cone is formed. The specially fabricated flux chamber with a larger skirt was used to ensure that a seal was created with the solids and that the chamber did not slide from its original location. Only freshly screened solids were measured for ammonia emissions. Freshly screened solids were denoted by a noticeably darker color and the presence of the conveyor outlet directly above the pile being tested.

Mixing Tank Measurements

The mixing tank, measuring 10.7 by 13.7 meters, was measured for ammonia emissions using the same equipment as each lagoon: the pontoon system (Appendix B.2). During summer sampling two measurements were made on the mixing tank surface during agitation. During sampling, the duration of agitation exceeded one hour – thus the measurement occurred for mixing only. The two measurements varied widely in final values due to the extraordinarily large spatial and temporal variability inherent when agitating such a large quantity of variable matter. The agitation created air pockets that broke under the chamber, as well as upwelling that brings variable matter in contact with the chamber. To decrease the spatial variability due to surface agitation, nylon ropes were used to secure the pontoon to the safety fence surrounding the tank to prevent the chamber from movement during the sample, although some movement occurred. The mixing chamber was not sampled during the winter trip as the results of the summer sampling trip did not indicate that this non-quiescent surface was a measurable source of ammonia emissions.

Open Lot Measurements

One open lot was selected as a representative open lot for the dairy. During summer conditions six measurements were taken over the entire open lot, comprising shaded and non shaded areas, and dry and moist areas. During winter conditions seven measurements were taken, encompassing the same areas as the summer trip. The moist areas were further divided into moist from urine and feces and moist from water displaced from the watering trough. A gum rubber gasket was created that fit tightly around the base of the chamber and extended radially for twelve centimeters to ensure that no air escaped from underneath the cylindrical section. This preserved the higher pressure inside the chamber and helped to isolate the chamber. Each wet area showed a higher ammonia emission concentration, so the percent of the open lots that were wet was noted to aid in total emission factor calculation. The percentage of each type (wet and dry) was used to weight the final average ammonia emission concentration over the entire open lot area.

Free Stall Measurements

One free stall was selected as a representative free stall for the dairy. During summer conditions five measurements were taken over the span of the free stall. Three measurements were made on the feeding side of the loafing bunks and two were made on the empty side of the bunks. During winter conditions five measurements were taken over the span of the free stall, also encompassing the feed and non-feed sides of the loafing bunks, as well as the watering area. Because the free stalls had concrete floors with grooves, each measurement was made using the gum rubber gasket to seal the chamber to the floor. The summer measurements comprised the majority of one day, but a problem originating at the mixing tank prevented the normal flushing cycle from occurring. Instead of temporal variability from flushing, spatial variability and loading variability were used to simulate the typical variability from flushing. One sample was taken from the watering trough: this area is not affected by flush water because the flush water cannot reach this elevated section, which separates the feed and non feed side alleys. The flushing system operated as scheduled during the winter trip, and samples were taken throughout the day, but included times directly before and after flushing occurred.

Error Handling

To verify the accuracy of measurements, ammonia concentrations measured by the analyzer were hand-recorded at the end of the final thirty minutes of each measurement. In obvious cases of error displayed on the computer monitor, such as spikes from constant concentration to zero, the erroneous data was removed. The predominant occurrence of spikes and lost data arose from technical difficulties logging data from the analyzer to the appropriate storage file.

The analyzer used in the ammonia measurements had different concentration ranges over which it could detect. During the summer research a 0-20 PPM mode was used. This mode read ammonia concentrations up to 27 PPM. Above 27 PPM the machine did not differentiate concentrations. This mode provided the most accurate measurements on low concentration ammonia samples, but could not read samples above 27 PPM. There were five instances were the analyzer read 27 PPM from an area source: two from free stall, two from the second lagoon, and one from the open lot. These measurements will not be included in the final emission factor determination as their true value is not known. This will skew the value down as the true value was above 27 PPM. During winter conditions the range was increased to 0-100 PPM and no samples were lost due to this error.

Ammonia Adsorption

Ammonia is an extremely reactive gas. Care was taken to create a static environment that minimized the amount of ammonia lost through handling, but this could not be completely prevented. Laboratory experiments were performed to determine the amount of ammonia that could be expected to adsorb on the surface of the polymer tubing (Teflon) from the flux chamber to the analyzers. Each test allowed the analyzer to sample ambient air for 10 minutes, then a pre-set ammonia concentration for 60 minutes, and allowed for any desorption for an additional 20 minutes. The 60 minute sampling of ammonia mimicked the same conditions found in the flux chamber protocol. By completing factorial experiment design, the amount of ammonia that was adsorbed by the polymer tubing could be approximated. The treatments included: two temperatures (26.7 and 38.8 ^{o}C), two tubing lengths (15.2 and 45.7 meters), and six concentrations (2, 5, 10, 15, 25, and 35 PPM). Teflon tubing was used exclusively in the flux chamber experiments to transport the pollutant stream from the chamber to the analyzer, and thus was the only tubing used in this experimental design. Analyzing the 72 individual experiments (3 trials of the 24 treatments listed above) statistically proved that there are losses of ammonia through 15.2 and 45.7 meter sections of tubing. Multiple regressions using SAS 8.01 (SAS, Inc., Cary, North Carolina) were performed to model the experimental results while also allowing interpolation as shown in Equation 25. This equation allowed the concentration from the GLAS to be estimated from knowledge of the concentration read by the analyzer and the length of tubing used to convey the material.

$$C_{GLAS}=0.994\cdot C_{Analyzer}+0.031\cdot T \qquad (25)$$

where:

C_{GLAS} = Ammonia concentration at tubing outlet from flux chamber (PPM)

T= temperature inside flux chamber (^{o}C)

$C_{Analyzer}$ = Concentration at tubing exit (at analyzer) (PPM)

The ambient, surface, and flux chamber temperatures were recorded using the data loggers during flux chamber measurements, and the concentration was recorded and logged by the LabVIEW software. Tubing length did not have an affect on the adsorption of ammonia at a 95% confidence level (α=0.05). Using Equation 23, the 31 summer measurements taken at the dairy could be corrected for ammonia adsorption losses. The temperature in Equation 23 was the temperature at the inlet of the analyzer and not the outlet of the chamber. It is assumed that the temperature does not appreciably change over the length of the Teflon tubing since both the tubing and chamber are exposed to the same approximate atmospheric conditions. The winter data cannot be corrected as the average temperatures experience during the winter sampling were well outside of the lower temperature bounds of the experiment (4 ^{o}C compared with 27 ^{o}C). Summer conditions are assumed to be worst-case conditions, and additionally correcting for adsorption losses will create the most conservative estimate of an ammonia emission factor.

Nitrogen Mass Balance

By the law of mass conservation, the amount of nitrogen that leaves the dairy is equal to the amount of nitrogen that enters the dairy plus any nitrogen stored in the dairy in animal body reserves. In addition, the amount of ammonia available is a function of the amount of nitrogen available. The purpose of this research was to quantify the amount of nitrogen that was fed to the cows and follow this nitrogen throughout the digestion and waste handling processes at the dairy. This gave a theoretical limit on the amount of ammonia that could be emitted from the dairy. This value was verified with the amount of ammonia estimated from the emission factor development to test if the factor was reasonable. The first step in determining the amount of nitrogen available for ammonia emissions was to test the feed for nitrogen. Six independent samples of feed were analyzed for nitrogen content: three each from two different feed rations. This dairy mixed two different feed rations: one for high milk producing cows and one for lower producing and dry cows. Each sample was a composite of 15 feed samples taken from a freestall barn. Samples were also taken from the freshly excreted free stall manure and urine, open lot scraped manure, mixing tank contents, separated solids, compost, and each lagoon. The waste process samples were composites of ten samples per individual sample. Barn manure was collected from the freshest available manure excreted in the barn. Urine was collected directly from each sampled cow. All samples were packed on dry ice and immediately sent to the Herman Heep Soil Testing Laboratory in College Station, Texas for processing using standard methods (American Public Health Association, 1995). Two different methods were used to test the amount of nitrogen excreted from the dairy. The first method was a nitrogen mass balance that followed the nitrogen as it moved throughout the dairy. This method uses information specific to the dairy, such as milk production numbers and the number of calves culled each year, as well as standards from the National Research Council (NRC, 2002), such as nitrogen content of heifers. The second method used American Society of Agricultural Engineers (ASAE, 1999) standard manure characteristics and the samples obtained from the dairy to estimate nitrogen directly. Both methods are outlined in Appendix B.4.

Results

Ammonia Emission Concentration Measurement

Thirty-one ammonia concentration samples were collected over the span of five days in August 2002 and twenty-nine samples were collected over the span of four days in January 2003. The breakdown of each type of sample and location are indicated in Table 7. The procedure described in this paper was used to determine each concentration.

Table 7. Sampling Breakdown of Winter and Summer Sampling Trips.

Season	**Summer**	**Winter**	**SUM**
Operation	**Samples**		
Compost	6	3	9
Free Stall	5	5	10
Dry Open Lot	3	3	6
Wet Open Lot	3	4	7
Separated Solids	3	2	5
Mixing Tank	2	0	2
1st Lagoon	5	6	11
2nd Lagoon	4	6	10
SUM	**31**	**29**	**60**

Table 8 displays the final actual concentrations for each waste process. Following the methodology outlined in this paper, the concentration in parts per million was converted into an emission rate. The emission rate was then converted into an emission factor. The concentrations for each unit process were determined from the average concentration at each process. For each of the 60 measurements, the average concentration from the final 30 minutes was used as the emission concentration. Some measurements were affected by outside factors such as generator failures or condensation propagation inside tubing. Each instance of outside factors is noted in their corresponding figures (summer and winter measurements appear in Appendix B.5). All raw data from the sixty samples are located in Appendix D.

Table 8. Ammonia Emission Averages for Each Unit Process.

Season	**Summer**		**Winter**	
Unit Process	**Concentration (PPM)**	**Standard Deviation (Samples)**	**Concentration (PPM)**	**Standard Deviation (Samples)**
Compost	3.1	3.9 (5)	17.4	9.5 (3)
Free Stall	10.3	6.3 (3)	36.4	18.7 (5)
Dry Open Lot	14.8	4.4 (3)	6.5	3.6 (3)
Wet Open Lot	19.6	7 (2)	14.1	3.4 (4)
Separated Solids	20.5	1.6 (2)	9.3	0.9 (2)
Mixing Tank	11.7	15.7 (2)	n/a	n/a
1st Lagoon	13.8	5.2 (6)	2.0	0.5 (6)
2nd Lagoon	16.8	10.2 (2)	0.4	0.3 (6)

By utilizing a spreadsheet the temperature inside the flux chamber could be matched with the instantaneous concentration. The emission factor was then expressed as the emission rate divided by some form of activity used to classify the source of the emission for this example it is animals and time (Table 9 for summer and Table 11 for winter).

Table 9. Ammonia Emission Factors and Ambient Conditions: Summer Data.

GLAS*	Conc. (PPM)	GLAS Temp(°C)	E Flux (µg/ m²/ s)	Area (m²)	ER (µg/s)	EF (kg/yr/ head)	EF (kg/day/1000 head)	Ambient Temp (°C)
Compost[5]	3.1	37.2	0.9	2.1E+04	2.0E+04	0.3	0.8	41.4
Free Stall[5]	10.3	29.3	3.2	1.0E+04	3.3E+04	0.5	1.4	29.3
Dry Open Lot[3]	14.8	28.6	4.5	2.6E+04	1.2E+05	1.7	4.8	33.9
Wet Open Lot[3]	19.6	28.0	5.9	1.4E+03	8.0E+03	0.1	0.3	33.9
Separated Solids[3]	20.5	43.6	6.4	1.1E+02	7.0E+02	0.0	0.0	36.0
Mixing Tank[2]	11.7	35.3	3.6	1.5E+02	5.2E+02	0.0	0.0	35.3
1st Lagoon[5]	13.8	31.7	4.3	1.4E+04	6.1E+04	0.9	2.5	32.3
2nd Lagoon[4]	12.8	28.0	3.9	1.6E+04	6.0E+04	0.9	2.5	30.6
Statistics	**13.3[a]**	**32.7[a]**	**4.1[a]**	**88828[b]**	**3.7E+04[a]**	**4.5[b]**	**12.3[b]**	**34.1[a]**

* number of samples collected
a= average, b= summation

One compost sample was taken directly after the compost was mechanically turned. This sample was deemed not representative of the time-averaged concentration of ammonia released from compost.

The summer data was also corrected for adsorption losses. These new concentrations and resultant emission factor are outlined in Table 10. Taking adsorption into account raised the emission factor from 12.3 to 13.3 kilograms per day per 1000 animals (an increase of 8.3%). If the adsorption is not taken into account, more than one kilogram per day per 1000 animals may be lost, leading to a lowered bias of the actual emissions of ammonia. The ambient and chamber temperatures fell within the limits of the adsorption experiments in all cases except compost, which had a slightly higher ambient temperature (41.4 compared to 37.8 °C). The values found in Table 10 will be used for the remainder of this discussion.

Table 10. Corrected Summer Ammonia Emission Factors.

	Concentration (PPM)	EF (kg/ yr/ head)	EF (kg/ day/ 1000 head)
Compost	4.2	0.4	1.1
Free Stall	11.1	0.5	1.5
Dry Open Lot	15.7	1.8	5.1
Wet Open Lot	20.5	0.1	0.4
Separated Solids	21.4	0.0	0.0
Mixing Tank	12.7	0.0	0.0
1st Lagoon	14.7	1.0	2.7
2nd Lagoon	13.6	1.0	2.6
Statistics	14.2[a]	4.9[b]	13.3[b]

a= average, b= summation

Table 11 displays the winter ammonia emission factor. As mentioned previously, no adsorption work could be done on the winter data, as the temperatures experienced during the sampling trip were well below the lower bound of the adsorption experiments. The emission factor determined from the winter sampling trip was 12.05 kilograms per day per 1000 animals.

Table 11. Ammonia Emission Factors and Ambient Conditions: Winter Data.

GLAS[*]	Conc. (PPM)	GLAS Temp. (^oC)	E Flux ($\mu g/m^2/s$)	Area (m^2)	ER ($\mu g/s$)	EF (kg/yr/head)	EF (kg/day/1000head)	Ambient Temp. (^oC)
Compost[3]	17.4	30.1	5.2	2.1E+04	1.1E+05	1.7	4.5	8.5
Free Stall[5]	36.4	6.4	11.0	1.0E+04	1.2E+05	1.7	4.8	6.3
Dry Open Lot[3]	6.5	-1.1	1.9	2.6E+04	5.0E+04	0.8	2.1	-1.0
Wet Open Lot[4]	14.1	-1.1	4.2	1.4E+03	5.7E+03	0.1	0.2	-1.0
Separated Solids[2]	9.3	3.6	2.9	1.1E+02	3.2E+02	0.0	0.0	3.7
1st Lagoon[6]	2.0	8.7	0.6	1.4E+04	8.5E+03	0.1	0.4	16.7
2nd Lagoon[6]	0.4	9.5	0.1	1.6E+04	2.0E+03	0.0	0.1	13.0
Statistics	**12.3[a]**	**8.0[a]**	**3.7[a]**	**88682[b]**	**4.6E+04[a]**	**4.4[b]**	**12.1[b]**	**6.6[a]**

[*] number of samples collected
a= average, b= summation

Summer Emissions Data

Figure 13 contains all of the sampling averages for each of the 31 summer measurements made with the isolation flux chamber method, as well as the overall average for each unit operation and its associated 95% confidence intervals. These values have been corrected for losses due to adsorption. These confidence intervals assume a normal distribution of measurements from the true measurement. The confidence intervals for the mixing tank are skewed due to the small number of samples taken. The upper confidence interval is above 100 PPM, which is below the theoretical limit based on the nitrogen mass balance (see Table 13), but far above sensory limits (Holland, 2001). As shown in Table 14, the total emissions from the tank are still negligible due to its small source area (0.17% of total emissions). A log-normal scale was used to accurately depict both high and low concentrations.

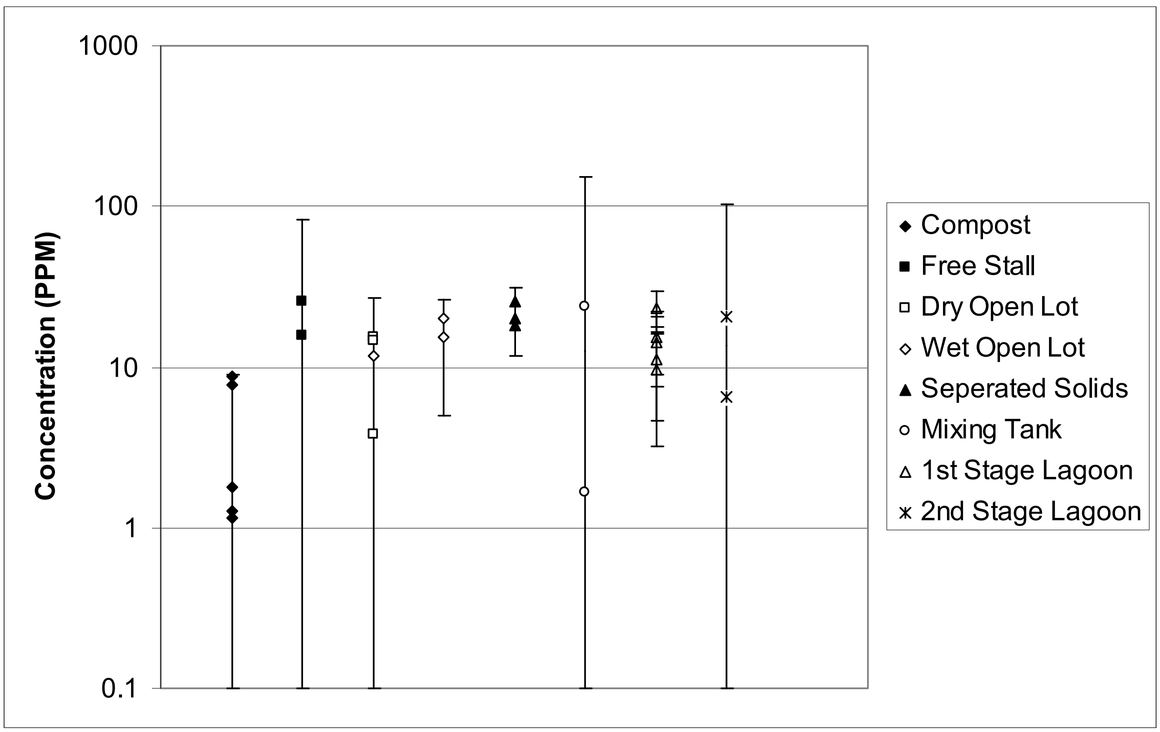


Figure 13. Summer Ammonia Emission Concentrations and 95% Confidence Intervals.

Winter Emissions Data

Table 11 summarizes the ammonia concentrations and conditions during ambient sampling of winter conditions. The average temperature decreased approximately 27 degrees Celsius between summer and winter sampling trips. Irregardless of this fact, the overall ammonia emissions did not decrease significantly between the two sampling trips. Figure

14 contains all of the sampling averages for each of the 29 measurements made with the isolation flux chamber method, as well as the overall average for each unit operation. Figure 14 also presents the winter emission concentration of each unit process in PPM as well as the upper and lower 95% confidence intervals. These confidence intervals assume a normal distribution of measurements from the true measurement.

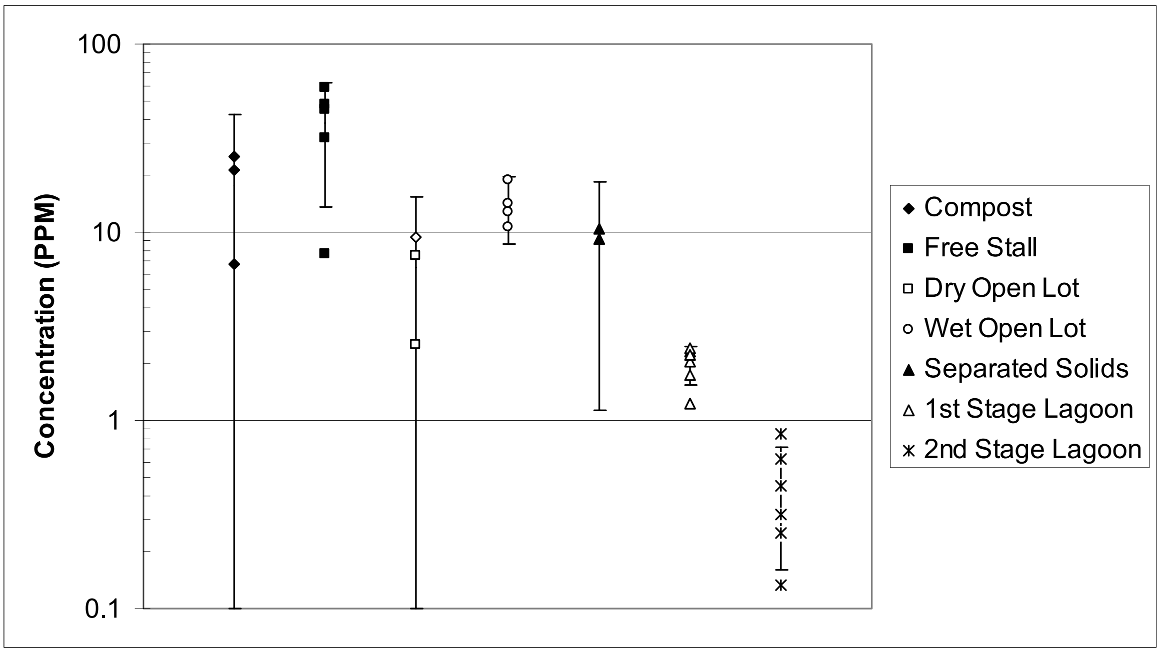


Figure 14. Winter Ammonia Emission Concentrations and 95% Confidence Intervals.

Figure 15 displays the variation of ammonia concentration and temperature recorded for the two lagoons during winter and summer conditions. The relationship correlates well with the work originated by Denmead et al., (1982), which showed a three-fold increase in ammonia concentration for a 10 ^{o}C increase in temperature. This work applied to a slurry system with a neutral pH. The average pH for the lagoons described in Figure 15 was 7.5.

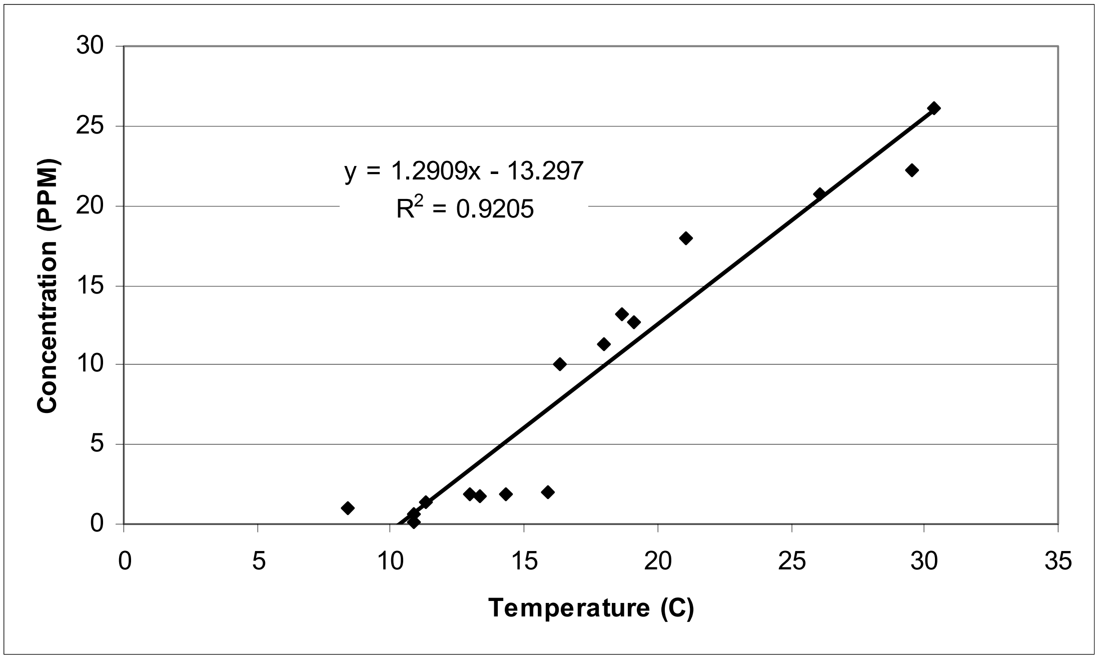


Figure 15. Relationship Between Temperature and Concentration for Central Texas Dairy Lagoons.

Table 12 displays the percentage of each unit process of the total emission factor for summer and winter conditions. In addition, the percent change from summer to winter is displayed. Both lagoons and the dry open lot decreased significantly from summer to winter, while the compost and free stall increased significantly from summer to winter. The wet portion of the open lot and separated solids did not significantly change, and the mixing tank was not sampled during winter conditions.

Table 12. Seasonal Variation in Percent of Each Unit Process in Total Emission Factor.

	% of Total: Summer	% of Total: Winter	% Change from Summer to Winter
Compost	8.2%	37.7%	29.42%
Free Stall	11.1%	39.7%	28.54%
Dry Open Lot	37.9%	17.0%	-20.85%
Wet Open Lot	2.6%	2.0%	-0.65%
Separated Solids	0.2%	0.1%	-0.12%
Mixing Tank	0.2%	n/a	n/a
1st Lagoon	20.1%	2.9%	-17.21%
2nd Lagoon	19.6%	0.7%	-18.95%

Nitrogen Mass Balance

The average of each set of samples collected as described in the Methods and Materials section is summarized in Table 13 (dry basis). The Water Quality Laboratory at Texas A&M University's Department of Biological and Agricultural Engineering was utilized to determine the percent solids of the barn manure using standard method 2540B (American Public Health Association, 1995). The barn manure had an average of 16.3% solids with a standard deviation of 0.75% (n=8). The differences for each feed and waste component are also graphically displayed in Figure 15. The highest concentration of nitrogen was found in the dairy feed for both types of animals (dry and lactating).

Table 13. Concentrations of Nitrogen for Feed and Waste Components.

Identification	Samples	TKN		NO_3-N		NH_4-N		Moisture	
		PPM	Std Dev	PPM	Std Dev	PPM	Std Dev	%	Std Dev
Lactating Cow Feed	3	28840	712.7	763	56.2	N/A	N/A	n/a	n/a
Dry Cow Feed	3	21807	627	379	14.8	N/A	N/A	n/a	n/a
Barn Feces	8	23420	1083.1	6.1	1.3	332.3	152.2	83.7	0.7
Separated Solids	5	14280	1461.2	8.2	1.3	29.6	7.4	79.5	6.5
Open Lot Scrapings	5	12660	2500.6	2.7	0.5	51.8	21.9	43.6	4.6
Compost	10	10850	5369	38.6	45.8	33.9	25.1	31.6	8.8
Barn Urine†	10	5549.1	1638.1	2.3	3.5	1633.5	1524.1	97.8	0.03
Mixing Tank	5	1319.2	159.9	1.6	0.3	706	120.6	n/a	n/a
Lagoon 1†	5	510	225.4	6.8	0.3	339.9	119	95.0	0.6
Lagoon 2†	5	332	115.2	9.2	0.2	219.8	104.3	95.5	0.5

†determined from total solids

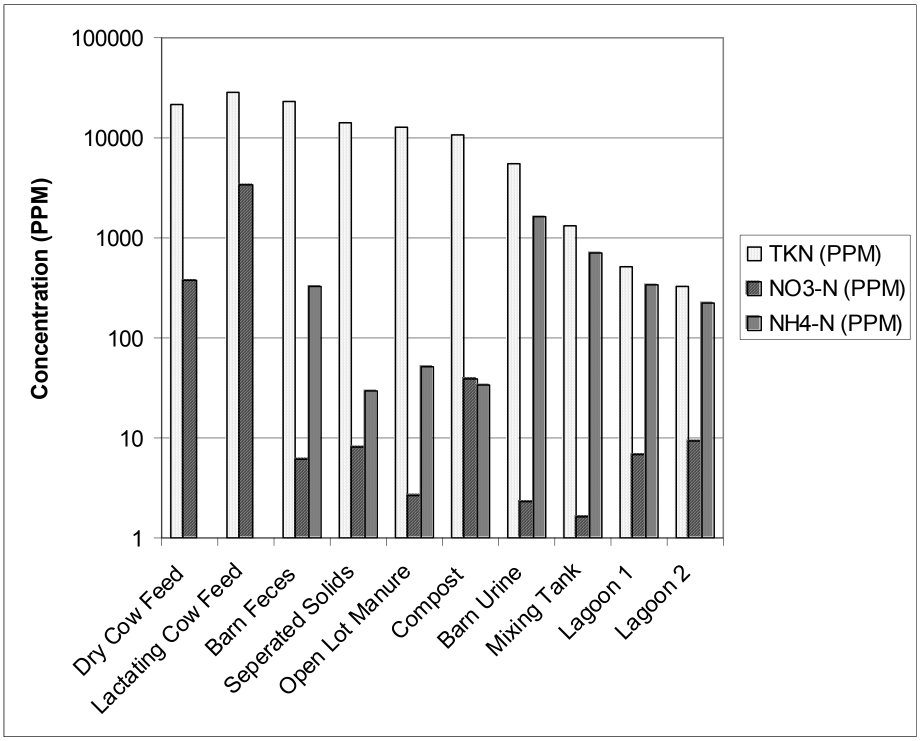


Figure 16. Concentrations of Nitrogen Components in Dairy Feed and Waste.

The total nitrogen mass balance was conducted as outlined in Appendix B.4. The dairy-specific variables were obtained through a survey of the owner of the facility. The standards that were used as constants were obtained from the National Research Council (NRC) (NRC, 2002). The mass balance estimated that 24.9 kilograms of total nitrogen were excreted from the dairy per animal per year (dry basis).

The American Society of Agricultural Engineers (ASAE) *Manure Production and Characteristics* (ASAE, 1999) standards were used as a comparison to the NRC mass balance. The complete ASAE method is outlined in Appendix B.4. This method estimated that 14.67 kilograms of total Kjeldahl nitrogen were produced per animal per year. These standards were also used to directly estimate the amount of ammonia produced from the dairy, 2.69 kilograms per animal per year (both on a dry basis). These standards do not list total nitrogen on an as-excreted basis, omitting any nitrate nitrogen from the dairy manure.

The physical specimens taken directly from the dairy were also used to determine the amount of nitrogen present in freshly excreted manure (Appendix B.4). For total nitrogen, the actual concentrations and moisture content of the manure sampled were used. ASAE standards for manure and urine production rates were used to provide masses for the concentrations determined. This method estimated that 66.5 kilograms of total nitrogen were excreted per animal per year (dry basis). The average of the summer and winter ammonia flux chamber measurements was used as the estimate of the amount of ammonia present (4.6 kilograms of ammonia per animal per year). The comparison of the three methods is outlined in Table 14.

Table 14. Comparison of Techniques to Determine Excreted Nitrogen.

Method	kg Nitrogen / animal/ year	kg Ammonia / animal / year	Percent of ammonia from nitrogen
NRC Method	24.9	1.99†	8.0%
ASAE Method	14.7*	2.7	18.3%
Dairy Samples	66.5	4.6††	7.0%

† assuming 8% of ammonia volatized from total nitrogen (Hutchings et al., 2001)
†† from average emission factor determined from flux chamber measurements
* standard only available for TKN, not total nitrogen

The average percent of ammonia from total nitrogen ranges from 7 to 18.3%, with an average of 11.1%. The total nitrogen mass balance method estimated that 24.9 kilograms of nitrogen per animal per year were excreted (dry basis), an increase of 10.2 kilograms per animal per year over the ASAE method.

Discussion

The final seasonal average emission factor developed with the flux chamber protocol is 4.64 kg ammonia per animal per year, four times less than the average value found from Table 3. The confidence intervals of the flux chamber measurements are within the range of the direct measurements (gas chromatography) but are well below the mass balance averages. It is hypothesized that the differences occur because of the conservative estimations used in determining the percentage of total nitrogen and ammonia excreted as well as the percent of ammonia volatized from excreted manure. The direct measurement techniques do not estimate the amount of ammonia that may be present in manure; these methods measure the amount of ammonia that is being released from the source.

The largest contributor to summer total emissions is the dry portion of the open lot (37.9% of the total emission factor). The average concentration is 15.7 PPM, and the area of all three open lots is larger than any other process. Other large contributors to total ammonia emissions include both lagoons (39.8% of total emission factor, combined). The compost, although not high in overall emission concentration, had a significant role in the overall emissions from the facility due to its large surface area (approximately 2.3 hectares). The mixing tank, separated solids, and wet open lot contributed only 3.0% of the total ammonia emissions. The three largest contributing waste processes (first and second lagoon and dry open lot) contributed 77.6% of the total ammonia mass emissions, although none of these processes were one of the highest two emission concentrations (separated solids and wet open lot). The individual figures showing the concentration of each of the 31 summer and 29 winter measurements for each minute that the sample was taken are located in Appendix B.5.

For winter conditions the highest contributor to total emissions was the free stall, followed closely by the compost (39.7 and 37.7%, respectively). The dry open lot, which was the highest contributor in summer emissions, decreased by over 20% during winter conditions. Both lagoons also decreased in emission rate by over 15%. In cases where emissions were higher in winter than summer, special circumstances help to explain the discrepancies. Because the formation of ammonia is driven by chemical and microbial activity, it is typically found that a decrease in temperature leads to a decrease in ammonia production and volatilization.

The temperature of the compost surface and shallow subsurface during winter conditions was 22 degrees higher than the ambient temperature. As a contrast, during summer conditions the compost was past the active stage and matured, with temperatures 4 degrees lower than the ambient temperature. This change in temperature during winter conditions is a result of an actively composting pile with increased microbial activity, thus increasing ammonia emissions through mineralization and volatilization. This increased activity and subsequent increased ammonia emission explains the discrepancy between the two seasonal compost readings. For compost, the age of the pile will also determine the amount of ammonia emissions as the pathways listed in Chapter I decrease in activity.

Ammonia emissions from the freestall barn also increased significantly during the winter measurements. There are several explanations for this increase. First, there were two (of five) cases from the summer sampling trip where the concentration measured were above 27 PPM and could not be used. Four of the five winter emissions were also above 27 PPM, but were measured because of the increased analyzer range. Second, misters were used during summer conditions to control the ambient temperatures for the higher producing cows. This extra water introduced into the system may have a dilution affect on the ammonia emissions by covering the GLAS surface with a small amount of water prior to sampling. Third, the flushing system was not operational during the summer conditions, so the daily variations were artificially created by attempting to select areas of increasing manure density for each sample. During winter conditions the flush system operated as usual, and the variation was obtained without attempting to pick more specific points throughout the barn. Finally, there exists not only a high spatial variation throughout and within the barns, but also seasonal changes due to the above factors. By only sampling during two times of one year with a total of eight concentrations, it is difficult to estimate the variations that occur throughout the entire year.

The summer conditions were modified using previous experimental work to model the losses of ammonia due to adsorption. These adsorption losses accounted for an 8% increase in emissions from the original emission factor. The compost was the only instance where the adsorption losses accounted for more than 8% of the original emission factor. In this case the losses were estimated to be 26%. This higher loss was due to the fact that compost had a low original (pre-adsorption corrected) concentration, meaning that any increase would magnify the percent increased from the original emissions. Additionally, the temperature from the compost was 3.5 ^{o}C above the high limit tested in the laboratory. This causes a small extrapolation from the model created. Because only two temperatures were tested, it is not known what secondary relationship exists between or outside of these points.

The nitrogen mass balance was used to estimate the amount of nitrogen available for ammonia, as well as the percent of ammonia that is formed from this excreted nitrogen. The entire range of ammonia from nitrogen ranged from 7 to 18.3% (Table 14), depending on which ammonia and total nitrogen values are compared. These values coincide with previous research reported by Hutchings (2001) that places the percentage of ammonia from total nitrogen at 3-10%, depending on which country is being studied. The amount of ammonia from total nitrogen was 7% when using data specifically from the central Texas dairy (total nitrogen from sampled feed rations and ammonia from flux chamber measurements). The preliminary emission factor determined from the isolation flux chamber measurements fell between the NRC and ASAE estimates of ammonia production.

The ratio of output nitrogen (urine and feces) to input nitrogen ranges from 71 to 77% based on the method used. This indicates that 21 to 29% of the input nitrogen is passed through the animal in the form of animal wastes. This value is within the accepted range of nitrogen uptake efficiency. Bucklin et al. (1992) estimate that 66 to 69% of input nitrogen is directly excreted (dry basis). The remaining nitrogen is lost through body storage and milk production.

Conclusions and Future Research

A protocol was developed for ammonia emissions sampling using an isolation flux chamber. Hardware and software were developed or fabricated to allow for ammonia emission concentrations at different waste processes (GLAS) throughout a hybrid dairy. Once the system and protocol were created, two sampling trips were made to measure the concentration of ammonia. The first took place in May of 2002, and the second in January 2003. By utilizing the protocol developed, emission factors were calculated for both sampling trips. During summer conditions, the average ambient temperature was 34.1 ^{o}C.

The emission factor calculated for these conditions and corrected for ammonia adsorption was 13.34 kilograms per day per 1000 cows. The average ambient temperature during winter conditions was 6.6 ^{o}C. The accompanying emission factor for winter conditions was 12.05 kilograms per day per 1000 cows, a decrease of 11%. This decrease can best be explained by the loss of ambient energy in the form of heat, which reduces microbial and chemical activity. There were certain areas (compost and free stalls) where secondary conditions such as microbial activity, sample variation, and seasonal management variations led to an emission increase.

The potential adsorption of ammonia onto the tubing used to convey the pollutant sample was also characterized and removed. An experimental design was created to test different temperatures and tubing lengths and their affects on the adsorption of ammonia. It was determined that length did not have an effect on adsorption (α=0.05). By utilizing the adsorption equation developed the emission factors for summer increased 8%. The winter conditions were not corrected for ammonia adsorption because of the low ambient temperatures experienced, which were not tested in the laboratory. The summer dairy conditions are considered to be the worst-case scenario for ammonia emissions due to the higher ambient temperatures, and by correcting the summer conditions the worst-case emission factor may be accurately estimated for Texas dairies.

To test the theoretical maximum ammonia production, a nitrogen mass balance was performed. This mass balance used NRC standards in conjunction with specific husbandry of the dairy to estimate the total amount of nitrogen excreted, or the amount of nitrogen available for ammonia production. The total amount of nitrogen was estimated to be 24.9 kilograms of total nitrogen per year per animal (dry basis). ASAE standards were also used, alone and in conjunction with samples taken from the dairy, to estimate the amount of total nitrogen. The ASAE standards alone estimated that 14.7 kilograms of total Kjeldahl nitrogen per year per animal were excreted. Using the concentrations of nitrogen specific to the dairy estimated that 66.5 kilograms of total nitrogen per year per animal were excreted. The ASAE standards also estimated that 2.7 kilograms of ammonia (dry basis) are produced each year, compared to 4.6 kilograms of ammonia (wet basis) released into the atmosphere per year. The percent of ammonia from total nitrogen varied from 7 to 18.3% depending on the methods used. The ratio of excreted to fed nitrogen was 71 to 79%, also depending on the method used to estimate total nitrogen.

This research outlined the steps required to perform flux chamber measurements to determine ammonia emission factors. In addition, several post-sampling steps were completed to ensure initial quality in the emission factor created from this protocol. The initial work done at the Comanche dairy was suited towards improvement of the measurement protocol, and to yield a preliminary estimate of ammonia emissions. In each waste-producing case the higher the number of samples, the lower the standard deviation and thus the higher the confidence in the reported results. Future work is required to greatly increase the number of samples taken at dairies. In addition, work to understand the diurnal and seasonal changes in ammonia emission must be competed to estimate a yearly emission average. If an average emission factor is taken between the summer, when conditions are most conservative, and winter, when conditions are most liberal, the emission factor is 12.7 ± 1.4 kilograms per day per 1000 head (average ± one standard deviation). Other variable factors such as rainfall events and droughts may also explain some seasonal variability.

CHAPTER V

CONCLUSIONS

The overall goal of this research was to create a scientifically sound, engineering based ammonia emission factor for Texas dairies. The first step in this research was the creation of a sampling protocol. This protocol was designed for use with an isolation flux chamber, a control volume enclosure used to measure ambient ammonia concentration. The protocol was based on previous research aimed to standardize flux chamber sizes and flow rates for the US Environmental Protection Agency. In addition, this research created software and hardware to increase the precision of the chamber: LabVIEW computer programs to control mass flow controllers and a chemiluminescence analyzer. Once the structure for sampling was created, two sampling trips were taken to a dairy in Comanche County, Texas during summer and winter conditions. The ambient temperature recorded during each trip varied by an average of 27.5 degrees Celsius. A total of 60 measurements were taken during the two separate sampling trips, encompassing compost, free stall, open lot, separated solids, mixing tank, first stage lagoon, and hybrid second stage lagoon waste handling operations. The largest portion of the emission factor during the summer trip was the dry portion of the open lot. For winter conditions the highest emission factor portion was the free stall barn. The dependence on both concentration and surface area denote that was was not necessarily high concentrations (separated solids) or large areas (compost) that yield a high portion of an emission factor (these processes are two of the lowest on the dairy during summer conditions).

This research helped to determine waste handling processes that require more or less attention during subsequent research to improve the collection of data. During the summer event the flushed manure mixing tank was measured. Although the ammonia concentration was high (12 PPM) the area was low enough (147 square meters) that the total emissions accounted for less than 0.2% of the total mass of ammonia from the dairy during summer conditions (assumed to be worst case conditions for ammonia formation and volatilization). Thus, it was not sampled again for winter conditions. The emission factor for summer conditions is estimated to be 13.34 kilograms per day per 1000 cows.

For winter conditions the emission factor is 12.05 kilograms per day per 1000 cows (an 11% reduction from summer conditions with adsorption losses removed). This reduction in ammonia released was a function of the corresponding ambient temperature reduction. This reduction leads to less ambient energy available to microbial and chemical activity that directly converts nitrogen to ammonia. In two areas (free stall and compost) the concentration increased from summer to winter.

In an effort to decrease any systematic errors inherent in the flux chamber protocol, the adsorption of ammonia onto polymer tubing used in the protocol was investigated. Different treatments (variables) were used to determine what ambient conditions might have an affect on adsorption. These treatments included: two temperatures (26.7 and 37.8 degrees Celsius), two tubing lengths (15.2 and 45.7 meters), two materials (perfluoroalkoxy (PFA) polytetraflouroethylene (Teflon) and low density polyethylene (LDPE)), and six ammonia concentrations (2, 5, 10, 15, 25, and 35 parts per million). The difference between the measured inlet tubing and exit tubing is considered the quantity of ammonia adsorbed during the experiment. Statistical analysis of the percent reduction of inlet concentration values allowed for the determination of significant treatments as well as a predictive equation. This predictive equation was used to estimate the amount of ammonia adsorbed during the summer sampling trip in Comanche County. The adsorption of ammonia onto Teflon and LDPE is controlled by different treatment factors for each material. For Teflon it appears that temperature and inlet concentration are the significant treatments that explain ammonia adsorption (α=0.05). This temperature is the measured temperature of the ammonia source, not the temperature measured at the analyzer inlet. For LDPE it appears as though all three treatments (tubing length, temperature, and inlet concentration) are important for the description of ammonia adsorption (α=0.05). The final predictive equations for both materials were displayed and explained. The associated t-tests to test the model, treatments, and regression are located in Appendices A.14 – A.16. Both models and both sets of variables are significant above a 99.9% confidence level, and both have adjusted r^2 values above 0.99.

In addition to the direct measurement technique of isolation flux chambers, a nitrogen mass balance was used to estimate the amount of ammonia present at the dairy. This mass balance used NRC standards in conjunction with specific husbandry of the dairy to estimate the total amount of nitrogen excreted, or the amount of nitrogen available for ammonia production. The total amount of nitrogen is estimated to be 177.5 kilograms of total nitrogen per year per animal (actual basis). ASAE standards were also used, alone and in conjunction with samples taken from the dairy, to estimate the amount of total nitrogen. The ASAE standards alone estimated that 14.7 kilograms of total Kjeldahl nitrogen per year per animal were excreted. Using the concentrations of nitrogen specific to the dairy estimated that 66.5 kilograms of total nitrogen per year per animal were excreted. The ASAE standards also estimated that 2.7 kilograms of ammonia (dry basis) are produced each year, compared to 4.6 kilograms of ammonia (wet basis) released into the atmosphere per year. The percent of ammonia from total nitrogen varied from 7 to 18.3% depending on the methods used. The ratio of excreted to fed nitrogen was 71 to 79%, also depending on the method used to estimate total nitrogen.

The ammonia measurement protocol developed for the isolation flux chamber was revised to exclude systematic error and compared with several other methods, both in previous literature and through mass balance approaches specific to this dairy. All of these comparisons and corrections were performed to isolate the best techniques to accurately measure ammonia. The mass balance techniques, regarded as conservative estimates of ammonia production, agree well with established mass balances performed over the last two decades. The initial isolation flux chamber work show that there exists a large seasonal variation in the production of ammonia. Even in worse-case conditions (corrected summer temperatures) the emission factor presented in this research is approximately five times less than the ASAE standards used to estimate the amount of ammonia present as excreted (on the same basis). The average flux chamber emission factor of summer and winter conditions is almost four times less than average factor found through the literature review, although the ASAE factor is within this range.

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APPENDIX A

A.1. CHEMILUMINESCENCE METHODOLOGY

Chemiluminescence analyzers allow for real time determination of gaseous air pollutants. The analyzer utilizes the reaction of nitric oxide (NO) with ozone (O_3) to create nitrogen dioxide (NO_2) and oxygen (O_2). This method does not directly measure ammonia, but determines ammonia through differencing of nitrogen-containing gases.

$$NO + O_3 \longrightarrow NO_2 + O_2 + h\nu \quad \text{(A-1)}$$

where:

h is Planck's constant ($6.63 \cdot 10^{-34}$ joule-seconds)

An air sample is drawn into the analyzer by an external vacuum pump, where it mixes with ozone generated by an internal ozone creator in a reaction chamber. The reaction creates a luminescence proportional to the concentration of NO through a light emission when the electronically excited NO_2 molecules decay to lower energy states. This emission is detected by a photomultiplier tube (PMT), which in turn generates a proportional electronic signal. This signal is then processed by the microcomputer into a NO concentration. To measure other nitrogen compounds, the digital signals must be subtracted based on the following equations.

$$NO_x \equiv NO + NO_2 \quad \text{(A-2)}$$

$$N_t \equiv NO_x + NH_3 \quad \text{(A-3)}$$

Solving for ammonia yields the following:

$$NH_3 \equiv N_t - NO - NO_2 \quad \text{(A-4)}$$

To measure NO_x the NO_2 must be transformed to NO prior to reaching the reaction chamber. This is performed by diverting the flow into a molybdenum converter heated to approximately 325 ^oC. Inside this chamber the converted molecules, along with the original NO molecules react with ozone. This resultant signal represents NO_x (NO_2 and NO). To measure N_t, both NO_2 and NH_3 must be transformed to NO prior to reaching the reaction chamber. This transformation occurs in a stainless steel converter heated to approximately 750 ^oC. As in NO_x, when reaching the reaction chamber the converted molecules along with the original NO molecules react with ozone. The resultant signal is N_t (NO_x and NH_3). To determine NH_3 concentration the N_t signal is subtracted from the NO_x signal. It is this signal that is used to determine the concentration of ammonia in parts per million (PPM).

A.2. DERIVATION OF CALIBRATION EQUATIONS

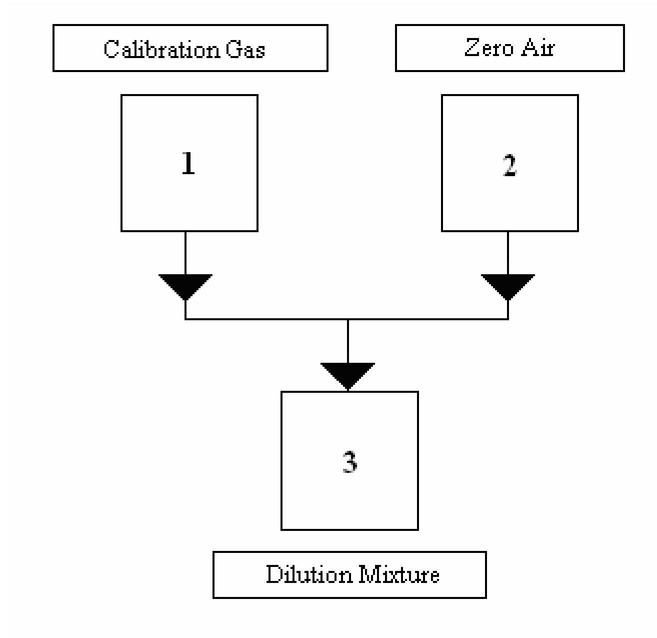

Figure A-1. Schematic of Calibration System.

The first equation used is the conservation of mass (Equation A-5). The numbering system used throughout this derivation is consistent with the numbering system displayed in Figure A-1. Both the calibration gas and the zero air exist in pressurized cylinders, whereas the diluted mixture is inside Teflon tubing at the exit of the system. Only Teflon is used in this experiment, as the analyzer is being calibrated. The tubing inside of the ammonia analyzer is also Teflon.

$$\dot{m}_1 + \dot{m}_2 = \dot{m}_3 \qquad \text{(A-5)}$$

where:

$\dot{m}$ = the mass flow rate of the enumerated system

From the definition of density, this equation can be modified to include density and flow rate.

$$\dot{Q}_1\rho_1 + \dot{Q}_2\rho_2 = \dot{Q}_3\rho_3 \qquad \text{(A-6)}$$

where:

$\dot{Q}$ = the volumetric flow rate of the enumerated system

ρ = the density of the gas at the specified point in the system

The density can be defined in terms of concentration in parts per million (PPM) and the ideal gas law.

$$\rho = \left(\frac{P}{RT}\right)\left(\frac{M_w}{1000}\right) \quad \text{(A-7)}$$

where:

P = atmospheric pressure
R = ideal gas constant (units dependent on units of other variables)
T = gas temperature
M_w = the molecular weight of the gas
ρ = the density of the gas

To determine the average molecular weight the concentration of the pollutant in the gas cylinders must be known. In this system each gas is balanced in pure nitrogen (N_2). Once the concentration is known a ratio may be taken for each part of the gas (one million parts per million).

$$M_w = \frac{C_1 M_1 + C_2 M_2}{10^6} \quad \text{(A-8)}$$

where:

C = the concentration in parts per million
M = the molecular weight in gram per mole

Once the average molecular weight of a calibration gas is determined, the density can be calculated from Equation A-9. A ratio of the two inlet gases will determine the density of the dilution gas.

$$\rho_3 = \frac{\dot{m}_t}{\dot{Q}_t} = \frac{\frac{m_t}{s}}{\frac{v_t}{s}} = \frac{m_t}{v_t} = \frac{\dot{m}_1 + \dot{m}_2}{\dot{Q}_1 + \dot{Q}_2} \quad \text{(A-9)}$$

where:

m_t = mass
v_t = volume
$\dot{m}$ = mass per unit time
$\dot{Q}$ = volumetric flow
s = time

Combining Equations A-6, A-7, and A-8 yields one formula for mass conservation.

$$\rho_1 \dot{Q}_1 + \rho_2 \dot{Q}_2 = \left(\frac{\rho_1 \dot{Q}_1 + \rho_2 \dot{Q}_2}{\dot{Q}_1 + \dot{Q}_2}\right)\dot{Q}_3 \quad \text{(A-10)}$$

A dilution ratio allows for conversion from one concentration to another through a background gas.

$$Cppm_3 = D_r \cdot Cppm_1 \tag{A-11}$$

$$D_r = \frac{V_g}{V_g + V_a} = \frac{\dot{Q}_1}{\dot{Q}_1 + \dot{Q}_2} \tag{A-12}$$

where:

D_r is the dilution ratio
V_g is the volume of calibration gas
V_a is the volume of zero air
Cppm is the concentration at that point in parts per million

Both concentrations are known quantities. The concentration at point one is the cylinder concentration of the specified gas. The concentration at point three is the specified outlet concentration required by the user. This leaves two equations and two unknowns, which can be solved for the unknown flow rates from the two cylinders. The final summed flow rate may be a constant or a user specified value. The molecular weights of the flow streams are all nearly 28 grams per mole, due to the fact that the calibration gas is balanced in nitrogen and has a low concentration (<100 PPM) and the zero air has a molecular weight near that of air, which is approximately 79% nitrogen. If the differences in molecular weight from each flow stream are assumed to be negligent, the equations reduce to concentration ratios.

$$\dot{Q}_1 = \dot{Q}_3 \left(\frac{Cppm_3}{Cppm_1} \right) \tag{A-13}$$

$$\dot{Q}_2 = \dot{Q}_3 \left(\frac{Cppm_1 - Cppm_3}{Cppm_1} \right) = \dot{Q}_3 \left(1 - \frac{Cppm_3}{Cppm_1} \right) \tag{A-14}$$

When the molecular weight differences are factored into the equations, the result becomes more accurate, but is different for each calibration gas and concentration. For the calibration and adsorption experiments, certified standard gases were acquired from Praxair, Inc (Bryan, Texas). Certified standard gases are guaranteed to be ±2% of the average concentration. For the NO cylinder used in this experiment of 50.8 PPM the equations become:

$$\dot{Q}_1 = \dot{Q}_3 \left(\frac{100000C_3}{103571C_1 - 3571C_3} \right) \tag{A-15}$$

$$\dot{Q}_2 = \dot{Q}_3 \left(\frac{103571(C_3 - C_1)}{3571C_3 - 103571C_1} \right) \tag{A-16}$$

For NH_3 at 46.2 PPM the equations become:

$$\dot{Q}_1 = \dot{Q}_3 \left(\frac{100000C_3}{103573C_1 - 3573C_3} \right) \tag{A-17}$$

$$\dot{Q}_2 = \dot{Q}_3 \left(\frac{103573(C_3 - C_1)}{3573C_3 - 103573C_1} \right) \tag{A-18}$$

Several gases were required to calibrate the NH_3 analyzer. To remove any background concentrations from the unpolluted air used to convey the pollution source, a source of zero grade air was required. This air had less than 1 PPM total hydrocarbons, less than 3 PPM CO_2, and less than 3 PPM H_2O. The defined procedure to remove background concentration is to allow a pure flow of zero air into the analyzer until the concentration of NH_3, NO_2, and NO are stable. This was defined in this research as a stable (less than a 1% fluctuation of full scale range) response for at least one minute. Once the response has stabilized, the machine was calibrated to remove that background concentration from the concentration that is measured. The next step in the calibration process was to introduce a known sample of NO calibration gas to the instrument. The analyzer must stabilize from the NO gas until the NO and NO_x responses have stabilized. Once again, the machine was calibrated to correct for the difference between the ideal concentration and the actual concentration that the machine measures. This gas calibrates the NO analyzer, but it does not check the efficiency of the ammonia conversion. This is accomplished using a known concentration of NH_3 gas. The analyzer must stabilize from the NH_3 gas until the NH_3 concentrations have stabilized. Once all of these gases are used and recorded, the machine was ready for ambient measurement. This dilution/calibration system was accurate to ±2%.

A.3. EXPERIMENTAL SETUP FOR CALIBRATION AND ADSORPTION

The zero air cylinder and calibration gas cylinder used in the experiment were connected to the proper regulators. The calibration regulator was stainless steel to lessen the chance of adsorption or desorption from the gas, especially when using ammonia. All tubing used in this experimental setup has an interior diameter of 0.635 cm (¼ inch). The tubing used in the calibration of the equipment was predominantly Teflon. Teflon tubing has one of the highest chemical resistances available, also lessening the chance of interference in the calibration process from the system itself. In this situation the tubing required to perform the adsorption experiment (not the tubing being specifically tested) was connected to the analyzer so that any adsorption losses would be negated by tuning the calibration to include those possible losses. In applications where only zero air was used in the tubing, low density poly-ethylene is used to control costs while not compromising the sensitivity of the system. The tubing used inside the analyzers was also Teflon. Teflon tubing was connected from the regulators to a dilution box via 0.635 cm (¼ inch) Teflon compression fittings. The lines were all static inside the box through the use of bulkhead compression unions. The schematic of the dilution box is shown in Figure A-2. This static container was created to stabilize the equipment for more precise experiments.

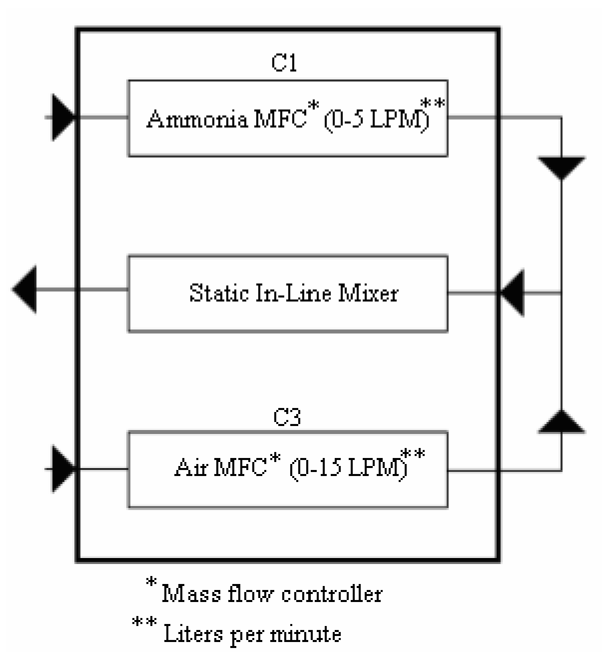

Figure A-2. Dilution Box Schematic.

Once the system was connected, each cylinder was turned on and set to a pressure of 20 pounds per square inch (PSI). This was the pressure at which the mass flow controllers (MFCs) used in the experimental setup were calibrated by the manufacturer.

A general schematic for the calibration experiment is shown in Figure A-3. Each cylinder being used (in this case ammonia and zero air) was connected to its MFC. The calibration gas was connected to a MFC that had a range of 0-5 LPM and the zero air was connected to a MFC that had a range of 0-15 LPM. The MFCs metered the specified flow as input by the user and defined by the software. After the constituents passed through their respective controllers they entered the static mixer and then flowed into the analyzer. In this calibration a total flow rate of 2 LPM was set, although the machine requires less flow rate to operate. The remaining gas was vented to a suitable location so that the machine was operating at atmospheric pressure and had a sufficient flow rate to operate.

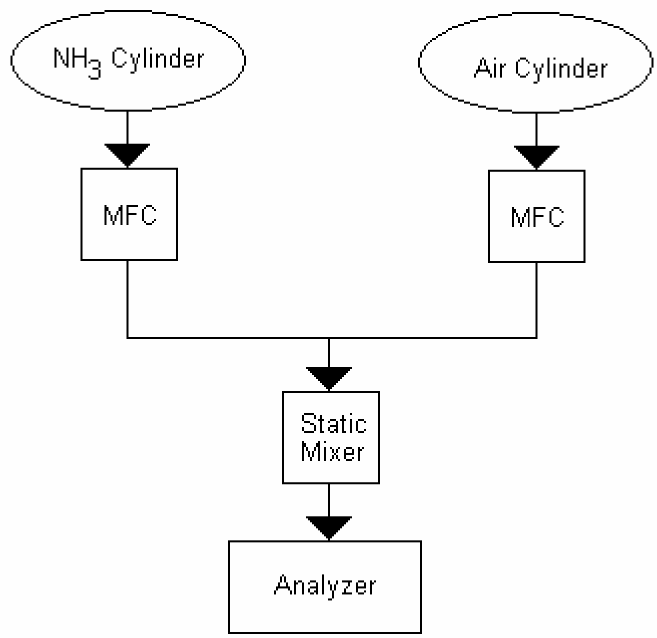

Figure A-3. Calibration System.

Figure A-4 outlines the unit processes in the adsorption experiment. The feature that was unique to this setup is the incubator. The incubator was used to control the different temperatures required in the experiment. The incubator acted like a heat sink, delivering energy in the form of heat to the Teflon and LDPE tubing inside. The different lengths of tubing were located inside the incubator and were connected to the flow path based on which length was being tested. Longer lengths had a longer residence time inside the incubator and thus had a slightly higher output temperature.

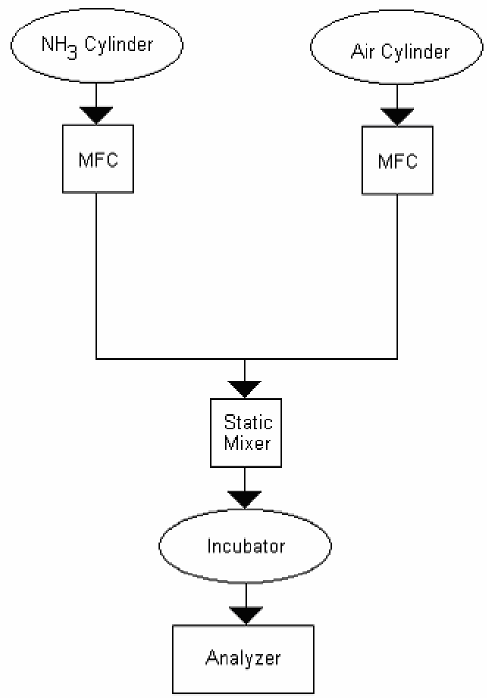

Figure A-4. Adsorption Schematic.

A.4. LABVIEW CALIBRATION PROGRAM SCHEMATIC AND SCREEN CAPTURE

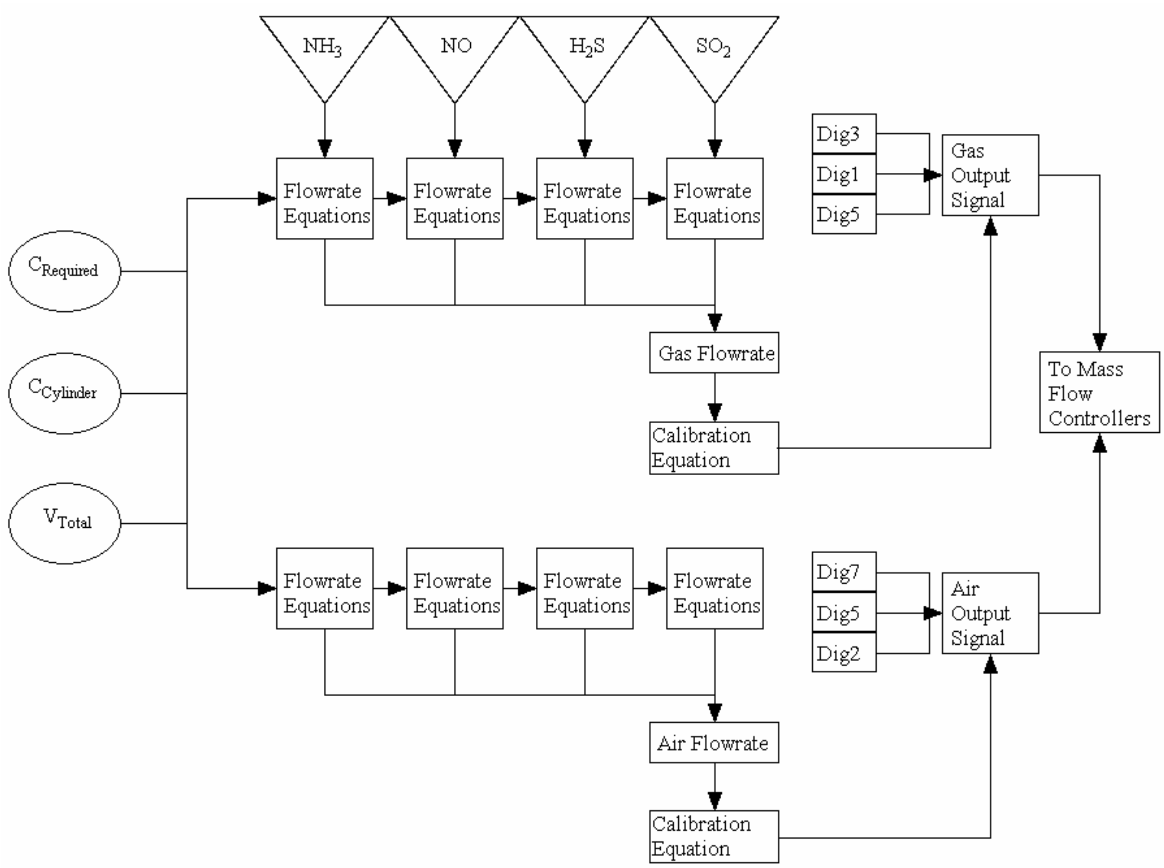

Figure A-5. Calibration Program Schematic.

A.5. LABVIEW ADSORPTION PROGRAM SCHEMATIC AND SCREEN CAPTURE

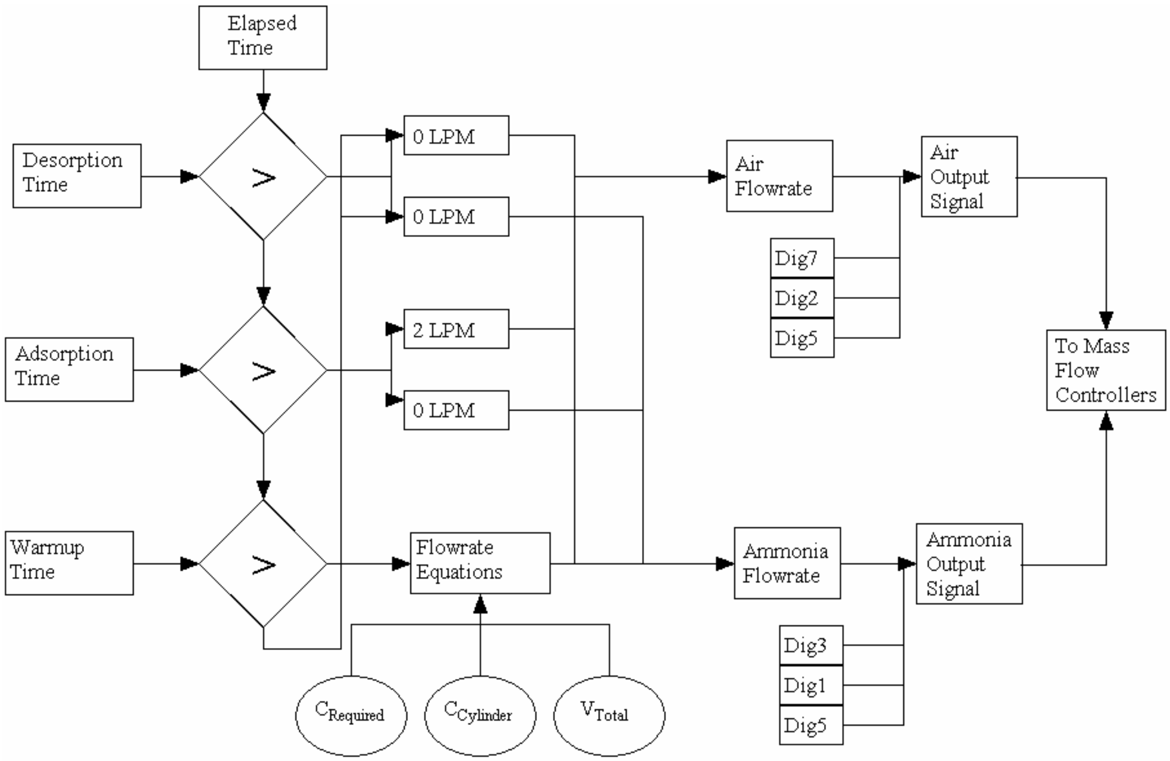

Figure A-6. Adsorption Program Schematic.

A.6. DATA ACQUISITION

A National Instruments Data Acquisition Card (NI DAQCard AI-16xe-50) in a Dell laptop personal computer was used to control two mass flow controllers as well as log data from the analyzers. The analyzers output a 0 to 10 volt (V) signal. These data as well as the 0 to 5 V signals from the mass flow controllers are logged with a logging program for data analysis.

Because the DAQ card cannot supply analog output, two digital to analog converters (DACs) were required. To allow the DACs to function, a driver was built to supply the correct outputs. This driver includes code that is used to translate the analog output value of the program into the digital input of the DAC. Table A-1 shows how each digital line is configured for the data acquisition card. The serial input of the DAC is described in Figure A-7. The CS (chip select) line of the DAC is pulsed before and after data is transferred. The SCLK (clock) line is pulsed to indicate a move from one bit to another. The DIN (data in) line is used to transport the individual bits of data to the DAC. The DAC accepts the data from most significant bit (MSB) to least significant bit (LSB). Since the internal construction of the 14-bit DAC is based upon a 16 bit bus, the last two bits sent to the DAC, called sub-bits, are ignored. For this reason, a low bit (zero volts) is sent for the last two (sub) bits in the driver.

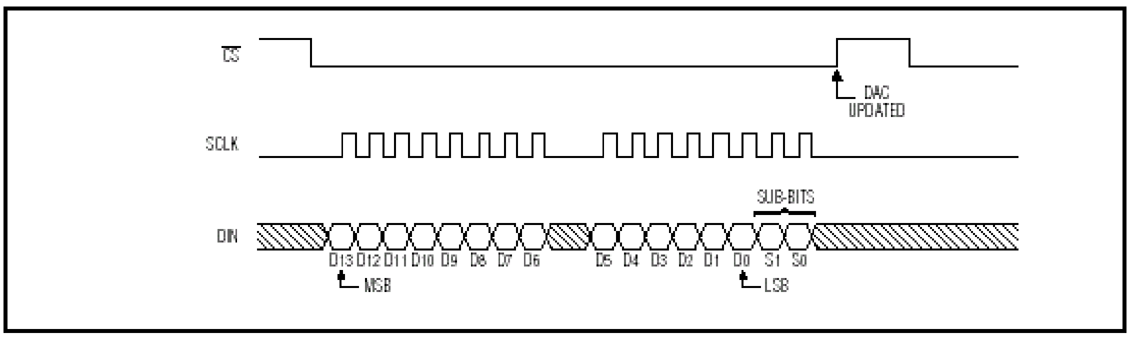

Figure A-7. Serial Input of Data Acquisition Card (DAC).

Table A-1 – Configuration of Hardware

Analog Inputs			
Channel Name	**Line**	**Voltage Range**	**Physical Range**
NH3	5	0-10 V	0-20PPM
Gas in	1	0-5 V	0-5 LPM
Zeroair in	0	0-5 V	0-5 LPM

Digital Outputs	
Channel Name	**Line**
dig0	0
dig1	1
dig2	2
dig3	3
dig4	4
dig5	5

A.7. SOFTWARE AND HARDWARE CONFIGURATIONS

Configuration is set up in the *Measurement and Automation* program provided by National Instruments. Each analog input is a referenced single ended connection. This denotes that one wire is connected to an analog ground and the other is the signal. The range is determined according to the ranges of the mass flow controller and the analyzer, respectively. Six digital lines are each configured as "write to line" because each is an output from the data acquisition card (DAC). The digital lines are also configured with no signal inversion, meaning a high bit is 5 volts and a low bit is 0 volts. The configuration for the analog inputs and digital outputs is set up as shown in Table A-1.

The driver was built with the knowledge of the input into the DAC. The driver requires 5 inputs: the input voltage, reference voltage, chip select (CS) channel, clock (SCLK) channel, and data in (DIN) channel. The input voltage is the voltage that needs to be output from the DAC. The reference voltage is set to 5V because the range of the output of the DAC should be 0 to 5 V. The other three inputs into the driver are the channel names as traced to the DAC. The driver operates by first converting the Input Voltage into a 14 bit digital array. A pulse is sent to the start/stop channel to begin the bit write. The bit is sent via the DIN channel followed by a pulse sent to the SCLK channel. Two sub bits are sent that are zero once the first 14 bits are sent. To end the transmission, a pulse is sent to the start/stop channel. The driver has an update rate of approximately 8 hz depending on the speed of the computer. The DAC then converts the digital signal to an analog output, which is sent to the flow controller.

The breakout box (NI SBC-68) houses the DACs and provides screw terminals to attach the input and output. Shielded cable is used for all inputs and outputs to prevent stray voltage from entering into the measurement. Using shielded cable allows for more accurate measurements by eliminating background voltages that would lead to improper voltage logging. The shielding is attached to the frame of the breakout box. Cables attach to the flow controller by a 15 pin D-subminiature connection.

A.8. LABVIEW LOGGING PROGRAM AND SCREEN CAPTURE

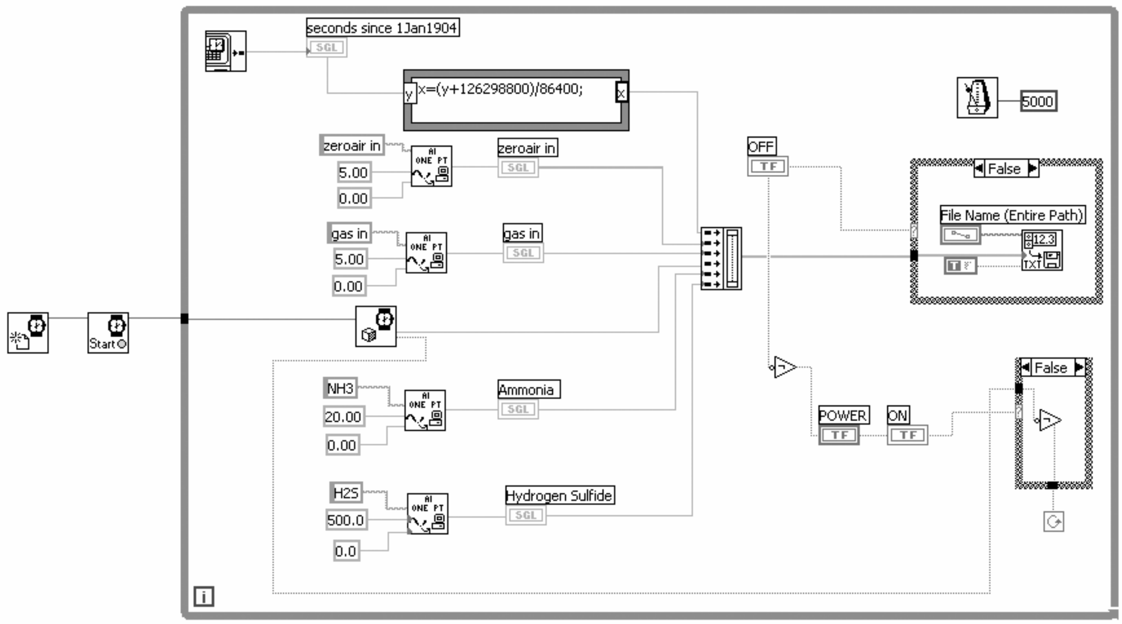

Figure A-8. Logging Program.

A.9. ADSORPTION EXPERIMENT DESIGN

Table A-2. Adsorption Experimental Design of Treatments

TEFLON													
Replication 1					Replication 2					Replication 3			
Trial	T*	C**	L***		Trial	T*	C**	L***		Trial	T*	C**	L***
1	37.8	15	45.7		1	26.7	15	15.2		1	37.8	15	45.7
2	37.8	5	45.7		2	37.8	5	15.2		2	26.7	5	15.2
3	26.7	15	45.7		3	26.7	15	45.7		3	26.7	5	45.7
4	26.7	15	15.2		4	37.8	15	15.2		4	37.8	5	45.7
5	37.8	15	15.2		5	26.7	5	15.2		5	37.8	15	15.2
6	26.7	5	15.2		6	37.8	15	45.7		6	26.7	15	45.7
7	37.8	5	15.2		7	26.7	5	45.7		7	26.7	15	15.2
8	26.7	5	45.7		8	37.8	5	45.7		8	37.8	5	15.2
9	26.7	2	45.7		9	37.8	10	45.7		9	37.8	2	15.2
10	26.7	2	15.2		10	26.7	10	15.2		10	26.7	10	15.2
11	37.8	10	15.2		11	37.8	2	45.7		11	26.7	2	45.7
12	26.7	10	45.7		12	37.8	2	15.2		12	26.7	2	15.2
13	37.8	2	15.2		13	37.8	10	15.2		13	37.8	2	45.7
14	37.8	2	45.7		14	26.7	10	45.7		14	37.8	10	15.2
15	26.7	10	15.2		15	26.7	2	15.2		15	37.8	10	45.7
16	37.8	10	45.7		16	26.7	2	45.7		16	26.7	10	45.7
17	37.8	25	45.7		17	37.8	25	15.2		17	37.8	35	45.7
18	37.8	35	45.7		18	26.7	25	15.2		18	26.7	25	15.2
19	26.7	25	45.7		19	26.7	35	45.7		19	26.7	35	45.7
20	37.8	25	15.2		20	37.8	35	45.7		20	37.8	25	15.2
21	37.8	35	15.2		21	37.8	35	15.2		21	26.7	35	15.2
22	26.7	25	15.2		22	26.7	25	45.7		22	26.7	25	45.7
23	26.7	35	15.2		23	37.8	25	45.7		23	37.8	35	15.2
24	26.7	35	45.7		24	26.7	35	15.2		24	37.8	25	45.7

LDPE													
Replication 1					Replication 2					Replication 3			
Trial	T*	C**	L***		Trial	T*	C**	L***		Trial	T*	C**	L***
1	37.8	5	15.2		1	37.8	5	15.2		1	26.7	5	15.2
2	26.7	15	45.7		2	37.8	15	45.7		2	37.8	5	15.2
3	26.7	5	15.2		3	26.7	5	15.2		3	37.8	15	15.2
4	26.7	5	45.7		4	37.8	5	45.7		4	26.7	5	45.7
5	37.8	15	15.2		5	26.7	15	45.7		5	37.8	15	45.7
6	26.7	15	15.2		6	26.7	15	15.2		6	37.8	5	45.7
7	37.8	5	45.7		7	37.8	15	15.2		7	26.7	15	15.2
8	37.8	15	45.7		8	26.7	5	45.7		8	26.7	15	45.7

* T=Temperature (C)
**C=Concentration (PPM)
***L=Length (m)

A.10. SYSTEM RESPONSE TO AMMONIA ADSORPTION

Figure A-9 details the output of one of the experiments. In this trial the laboratory treatments are: Teflon, 37.8 ^{o}C, 45.7 meters, and 15 PPM nominal concentration. The lag between the actual and ideal responses originates from the length of tubing (at 2 LPM and a 0.635 cm tubing diameter the mixture requires approximately 45 seconds to travel the entire tubing length) and the reaction of the analyzer. This analyzer requires 120 seconds to attain 90% of the full scale concentration (13.5 PPM in this trial). For this experiment the actual inlet concentration was 14.63 PPM and the outlet concentration was 13.39 PPM. The difference, or amount of ammonia adsorbed from the tubing, is 1.24 PPM (8.5% of inlet concentration).

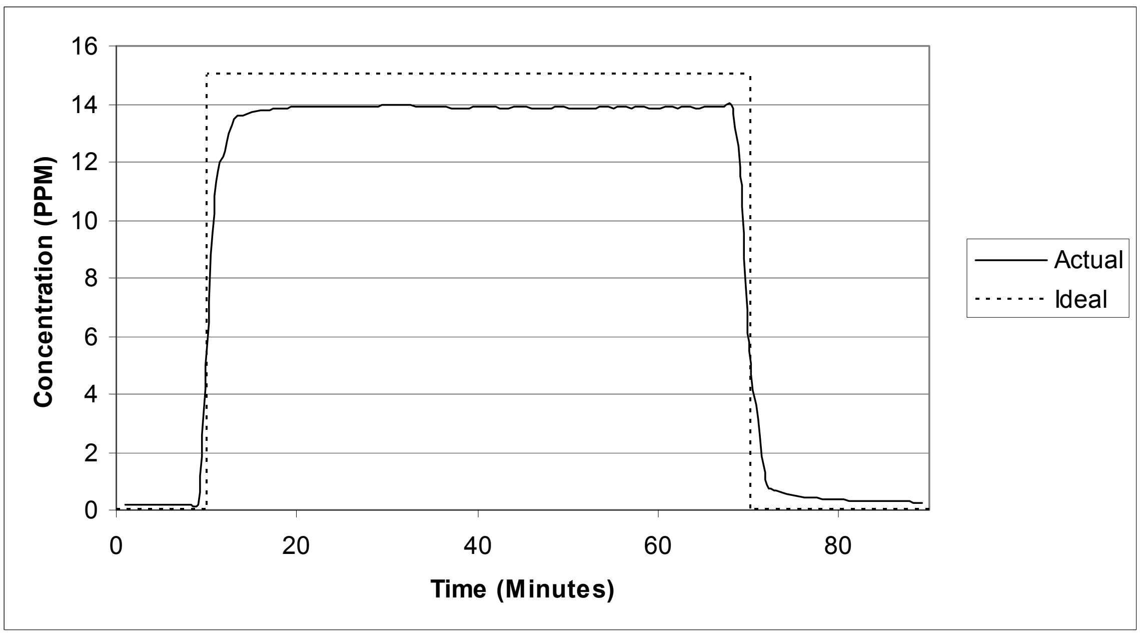

Figure A-9. Example Trial of Adsorption Software.

A.11. EXPERIMENTAL RESULTS FROM ADSORPTION EXPERIMENTS

Table A-3. Experimental Results from Ammonia Adsorption Experiments.

			Nominal Concentration	Inlet Concentration		Outlet Concentration		Diff	
	Temp. C (F)	Length m (ft)	C PPM	AVE PPM	STDEV	AVE PPM	STDEV	AVE PPM	STDEV
Teflon	25.17 (77.31)	15.5 (51)	2	2.30	0.04	1.10	0.08	1.20	0.09
	25.56 (78.01)	46.6 (153)	2	1.80	0.01	0.96	0.10	0.84	0.10
	36.57 (97.83)	15.5 (51)	2	2.30	0.05	1.09	0.04	1.21	0.08
	37.68 (99.82)	46.6 (153)	2	2.00	0.01	0.98	0.06	1.02	0.07
	25.17 (77.31)	15.5 (51)	5	5.00	0.10	4.81	0.16	0.19	0.14
	25.56 (78.01)	46.6 (153)	5	4.80	0.07	4.12	0.15	0.68	0.22
	36.57 (97.83)	15.5 (51)	5	5.40	0.09	4.72	0.04	0.68	0.06
	37.68 (99.82)	46.6 (153)	5	4.60	0.10	3.75	0.21	0.85	0.20
	25.17 (77.31)	15.5 (51)	10	10.20	0.32	9.12	0.07	1.08	0.33
	25.56 (78.01)	46.6 (153)	10	9.60	0.21	8.94	0.09	0.66	0.25
	36.57 (97.83)	15.5 (51)	10	10.50	0.33	9.13	0.12	1.37	0.33
	37.68 (99.82)	46.6 (153)	10	9.80	0.03	9.05	0.16	0.75	0.14
	25.17 (77.31)	15.5 (51)	15	15.10	0.27	14.24	0.79	0.86	1.00
	25.56 (78.01)	46.6 (153)	15	14.40	0.13	13.27	0.84	1.13	0.75
	36.57 (97.83)	15.5 (51)	15	15.30	0.33	13.10	0.58	2.20	0.34
	37.68 (99.82)	46.6 (153)	15	14.60	0.27	13.38	0.52	1.22	0.78
	25.17 (77.31)	15.5 (51)	25	24.50	0.27	24.15	0.26	0.35	0.23
	25.56 (78.01)	46.6 (153)	25	24.20	0.06	24.08	0.07	0.12	0.04
	36.57 (97.83)	15.5 (51)	25	25.30	0.50	24.35	0.11	0.95	0.40
	37.68 (99.82)	46.6 (153)	25	24.90	0.29	24.07	0.15	0.83	0.44
	25.17 (77.31)	15.5 (51)	35	34.40	0.41	34.27	0.46	0.13	0.05
	25.56 (78.01)	46.6 (153)	35	35.60	0.33	33.70	0.26	1.90	0.44
	36.57 (97.83)	15.5 (51)	35	34.43	0.20	34.28	0.07	0.15	0.19
	37.68 (99.82)	46.6 (153)	35	35.20	0.92	34.19	0.19	1.01	0.92
	Temp. C (F)	Length m (ft)	C PPM	AVE PPM	STDEV	AVE PPM	STDEV	AVE PPM	STDEV
LDPE	25.17 (77.31)	14.8 (48.5)	5	5.10	0.14	4.26	0.10	0.84	0.22
	25.56 (78.01)	45.3 (148.5)	5	4.80	0.07	3.50	0.36	1.30	0.31
	36.57 (97.83)	14.8 (48.5)	5	5.40	0.10	4.05	0.08	1.35	0.16
	37.68 (99.82)	45.3 (148.5)	5	4.90	0.10	3.16	0.12	1.74	0.16
	25.17 (77.31)	14.8 (48.5)	15	15.10	0.34	12.71	0.40	2.39	0.07
	25.56 (78.01)	45.3 (148.5)	15	14.40	0.19	11.72	0.27	2.68	0.43
	36.57 (97.83)	14.8 (48.5)	15	15.40	0.32	12.43	0.49	2.97	0.63
	37.68 (99.82)	45.3 (148.5)	15	14.70	0.29	11.12	0.35	3.58	0.60

A.12. ONE FACTOR ANOVA FOR MATERIALS TEST

Table A-4. Material Test of Variance.

SUMMARY

Groups	Count	Sum	Average	Variance
Teflon	24.000	23.43	0.976	0.523
LDPE	24.000	50.53	2.105	0.916

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Material	15.300	1	15.300	21.263	3.20E-05	4.052
Error	33.101	46	0.720			
Total	48.401	47				

A.13. REGRESSION CHARACTERISTICS FOR LDPE AND TEFLON EQUATIONS

Table A-5. LDPE Regression Characteristics.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	1.000
R Square	1.000
Adjusted R Square	0.999
Standard Error	0.141
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	194.757	64.919	3264.556	3.12E-07
Residual	4	0.080	0.020		
Total	7	194.837			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-1.791	0.305	-5.876	0.004	-2.638	-0.945
T	0.058	0.008	6.816	0.002	0.034	0.081
Length	0.019	0.003	5.791	0.004	0.010	0.028
Outlet	1.193	0.012	98.777	0.000	1.159	1.226

Table A-6. Teflon Regression Characteristics.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999
R Square	0.998
Adjusted R Square	0.953
Standard Error	0.504
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	3128.441	1564.221	6148.568	8.56E-30
Residual	22	5.597	0.254		
Total	24	3134.038			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0					
T	0.031	0.005	6.128	0.000	0.020	0.041
Outlet	0.994	0.009	114.036	0.000	0.976	1.012

A.14. ADSORPTION EXPERIMENT STATISTICAL DATA

Table A-7. Test for Treatment Significance.

Teflon					
	SS	d_f	MS	f_o	F_{Stat}
Concentration, C (PPM)[a]	5.42	5	1.08	6.17	2.41
Length, L (m)	0.05	1	0.05	0.30	4.04
Temperature, T (^oC)[c]	1.22	1	1.22	6.95	4.04
C·L [a]	6.96	5	1.39	7.93	2.41
C·T [c]	2.64	5	0.53	3.01	2.41
L·T [c]	0.72	1	0.72	4.09	4.04
C·L·T	1.22	5	0.24	1.39	2.41
Error	8.43	48	0.18		
Total	26.66	71			
LDPE					
	SS	d_f	MS	f_o	F_{Stat}
Concentration, C (PPM) [a]	15.25	1	15.25	107.32	4.49
Length, L (m) [c]	1.14	1	1.14	8.02	4.49
Temperature, T (^oC)[b]	2.23	1	2.23	15.67	4.49
C·L	0.00	1	0.00	0.01	4.49
C·T	0.11	1	0.11	0.74	4.49
L·T	0.02	1	0.02	0.17	4.49
C·L·T	0.06	1	0.06	0.40	4.49
Error	2.27	16	0.14		
Total	21.08	23			
Teflon vs. LDPE					
	SS	d_f	MS	f_o	F_{Stat}
Materials [a]	15.30	1	15.30	21.26	4.05
Error	33.10	46	0.72		
Total	48.40	47			

[a]=treatment has effect at a greater than 99.9% confidence level
[b]=treatment has effect at 99% confidence level
[c]= treatment has effect at 95% confidence level

APPENDIX B

B.1. FLUX CHAMBER DOLLY

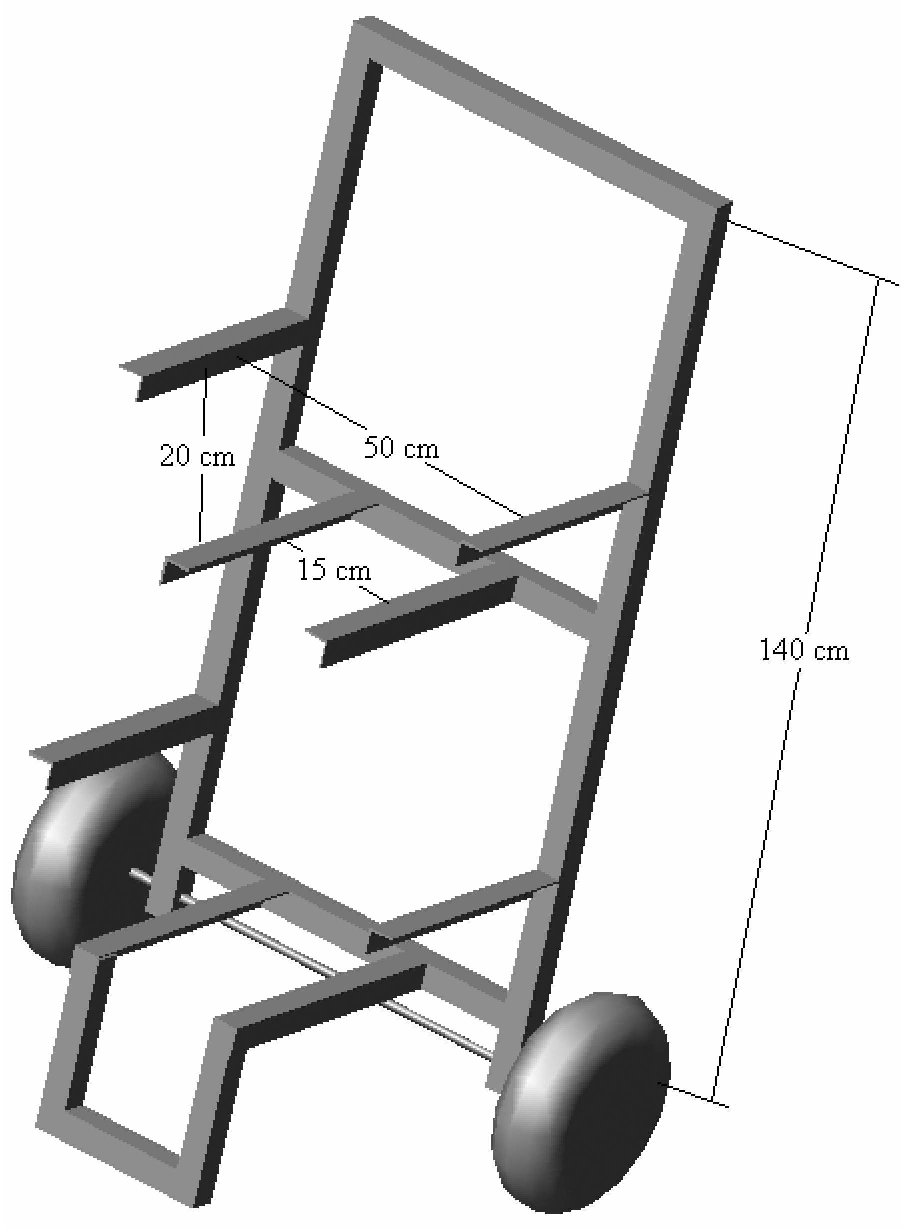

Figure B-1. Flux Chamber Dolly.

The dolly, pictured above, had available space for two chambers. The arms had holes drilled that allowed for pins to securely fasten the chambers through the available wing nut holes that normally seal the top and bottom of the chamber together. In addition, a steel chain secured the front of the chambers for shorter trips throughout the facility after the chamber had been fully assembled.

B.2. FLUX CHAMBER PONTOON SYSTEM

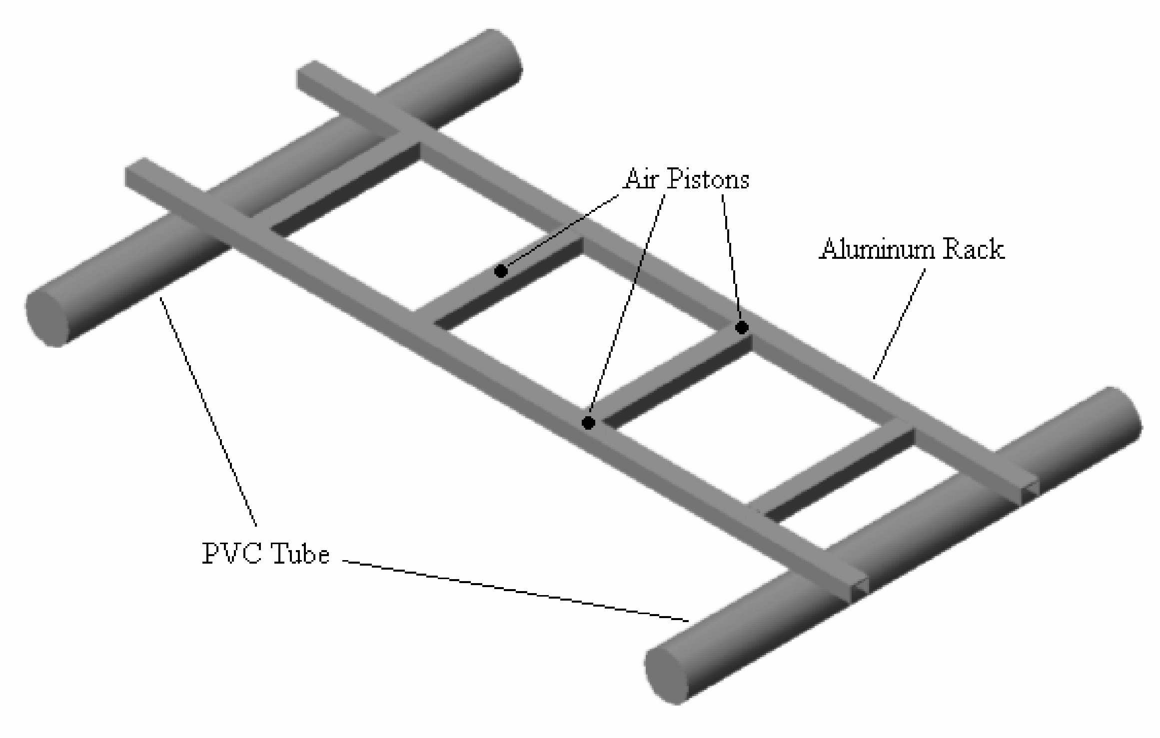

Figure B-2. Flux Chamber Pontoon System.

A schematic of the pontoon system is indicated above. This system could be disassembled into three distinct units for easy transport and storage. The base units were 1.5 meters in length and 25.3 centimeters in diameter poly vinyl chloride (PVC) pipes. Each pipe was sealed with 25.3 centimeter caps, one each having a plug attached in case leakage occurred. The pipes were attached to the structure with stainless steel bolts and nuts. The skeleton of the structure is lightweight aluminum. Three air pistons, compressed by an air compressor, were used to raise the chamber remotely.

B.3. LABVIEW TIMING PROGRAM SCHEMATIC AND SCREEN CAPTURE

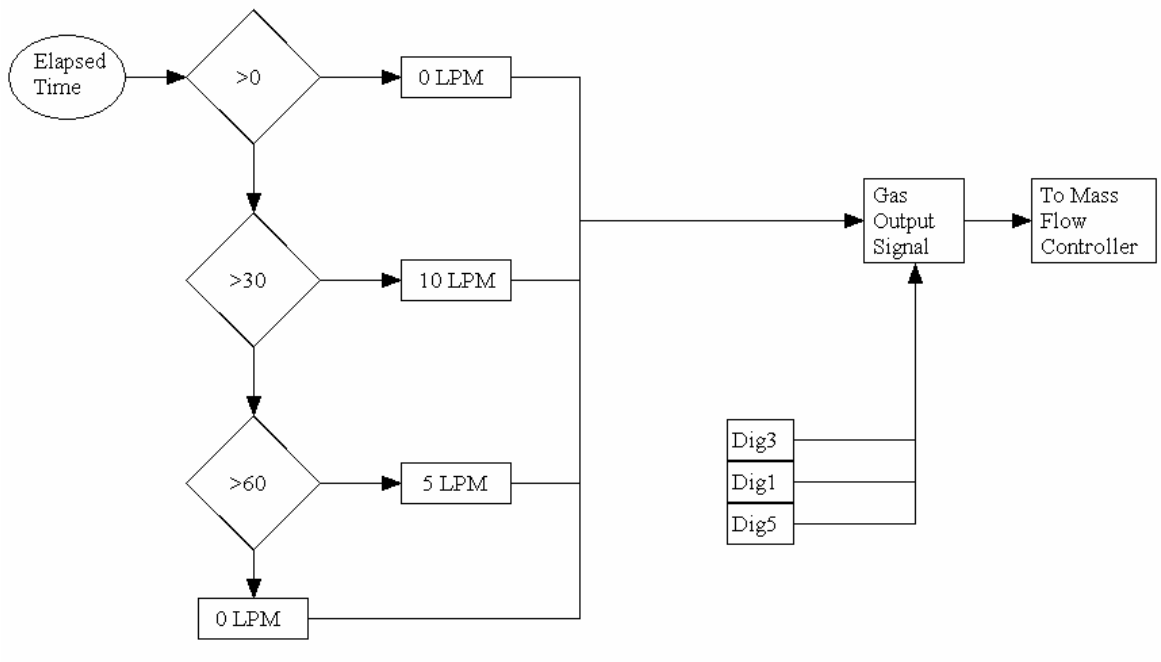

Figure B-3. LabVIEW Timing Program Schematic.

B.4. METHODS TO DETERMINE TOTAL NITROGEN AS EXCRETED FROM DAIRY COWS

NRC Total Nitrogen Dairy Mass Balance

$$N_{Excreted} = N_{Feed} - N_{Milk} - N_{Culled} - N_{Leaving} + N_{Heiffer} \tag{B-1}$$

where:

$N_{Excreted}$= Amount of nitrogen excreted from dairy cows
N_{Feed}= Amount of nitrogen input in feed
N_{Milk}= Amount of milk produced by herd
N_{Culled}= Nitrogen content in culled cows
$N_{Leaving}$= Nitrogen content of calves leaving farm
$N_{Heiffer}$= Nitrogen content of replacement heifers entering farm

$$N_{Feed} = C_{LR} \cdot M_{LR} \cdot N_{LC} + C_{DR} \cdot M_{DR} \cdot N_{DC} \tag{B-2}$$

where: C_{LR}= Concentration of nitrogen in lactating cow ration (determined from samples taken at dairy)
C_{DL}= Concentration of nitrogen in dry cow ration (determined from samples taken at dairy)
M_{LR}= Mass of lactating cow ration*
M_{DR}= Mass of dry cow ration*
N_{LC}= Number of lactating cows*
N_{DC}= Number of dry cows*

$$N_{Feed} = \begin{pmatrix} 29603\dfrac{mg\ N}{kg\ Feed} \cdot 22.68\dfrac{kg\ feed}{cow \cdot day} \cdot 1840\ lactating\ cows + \\ 22186\dfrac{mg\ N}{kg\ Feed} \cdot 15.88\dfrac{kg\ feed}{cow \cdot day} \cdot 250\ dry\ cows \end{pmatrix} \cdot \tag{B-3}$$
$$\frac{365\ days}{year} \cdot \frac{1\ ton}{1 \cdot 10^9\ mg} = 483.06\frac{tons\ N_{Feed}}{year}$$

$$N_{Milk} = M_M \cdot C_M \tag{B-4}$$

where:

M_M= Mass of milk produced per day (kilograms per day) *
C_M= Concentration of nitrogen in milk by weight (percent)†

$$N_{Milk} = 56818.2\frac{kg}{day} \cdot 0.005 \cdot \frac{1\ ton}{1 \cdot 10^3\ kg} \cdot 365\frac{days}{year} = -103.7\frac{tons\ N_{Milk}}{year} \tag{B-5}$$

$$N_x = C_x \cdot M_x \cdot N_x \tag{B-6}$$

where:

C= Concentration of nitrogen in body reserves[†]
M= Mass of animal[*]
N= Number of animals[*]
$_x$= Type of nitrogen (from culled, leaving farm, and entering farm)

$$N_T = N_{Heiffer} - N_{Culled} - N_{Leaving} \qquad \text{(B-7)}$$

$$N_{Heiffer} = \left(26000\frac{mg}{kg}\cdot 273\frac{kg}{head}\cdot 800\frac{head}{year}\right)\cdot 365\frac{days}{year}\cdot\frac{1ton}{1\cdot 10^9\,mg} = 5.68\frac{tons\ N}{year} \qquad \text{(B-8)}$$

$$N_{Culled} = \left(29000\frac{mg}{kg}\cdot 591\frac{kg}{head}\cdot 800\frac{head}{year}\right)\cdot 365\frac{days}{year}\cdot\frac{1ton}{1\cdot 10^9\,mg} = 13.71\frac{tons\ N}{year} \qquad \text{(B-9)}$$

$$N_{Leaving} = \left(29000\frac{mg}{kg}\cdot 43\frac{kg}{head}\cdot 1700\frac{head}{year}\right)\cdot 61\frac{days}{year}\cdot\frac{1ton}{1\cdot 10^9\,mg} = 0.35\frac{tons\ N}{year} \qquad \text{(B-10)}$$

$$N_T = 5.68 - 13.71 - 0.35 = -8.75\frac{tons\ N}{year} \qquad \text{(B-11)}$$

$$N_{Excreted} = N_{Feed} - N_{Milk} - N_{Culled} - N_{Leaving} + N_{Heiffer} \qquad \text{(B-12)}$$

$$N_{Excreted} = 483.06 - 103.7 + 5.68 - 13.71 - 0.35 = 370.98\frac{tons\ N\ excreted}{year} \qquad \text{(B-13)}$$

$N_{excreted}$= 370.98 tons total nitrogen per year = 177.5 kilograms per animal per year (2090 total cows). This is on an actual basis (body mass and milk are not on a dry basis). By using the fact that average manure is 14% solids[††], the amount of nitrogen excreted on a dry basis is 24.9 kilograms per animal per year (dry basis).

[†]= NRC (2002)
[††]= ASAE (1999)
[*]= From dairyman

ASAE Method

This dairy feeds a range of 21.8 to 23.6 kilograms of feed (dry matter basis) per lactating cow per day and 14.0-16.8 kilograms of feed per dry cow (average for calves, heifers, and dry cows) per day. By using the concentration of nitrogen in parts per million (or milligrams per kilogram) of the feed, the total input of nitrogen could be estimated (Equation B-14). Total nitrogen was defined as TKN and NO_3-N (values obtained through Herman Heep Soil and Crop Science (College Station, Texas) testing center).

$$\begin{pmatrix} 29603\frac{mg\ N}{kg\ Feed}\cdot 22.68\frac{kg\ feed}{cow\cdot day}\cdot 1840\ cows + \\ 22186\frac{mg\ N}{kg\ Feed}\cdot 15.88\frac{lb\ feed}{cow\cdot day}\cdot 250\ cows \end{pmatrix}\cdot\frac{365\ days}{year}\cdot\frac{1\ ton}{1\cdot 10^9\ mg} = 483.06\frac{tons\ N_{Feed}}{year} \qquad \text{(B-14)}$$

483.06 metric tons of nitrogen is input into the dairy per year from the feed, or 0.63 kilograms per day per cow [1.39 pounds per day per cow]. This number is within the accepted range of nitrogen input of 0.87-1.56 pounds per day per cow (Bucklin et al., 1992).

ASAE Method 1: ASAE Standards Only

The amount of ammonia that may be emitted was a function of the amount of manure that is excreted. This was estimated with knowledge of the concentrations from the laboratory analysis and standards of animal waste. The American Society of Agricultural Engineers (ASAE, 1999) publishes standards for various fields throughout the society. Using these standards 38.4 kilograms of manure and 16.64 kilograms of urine were produced per cow per day (based on an average weight of 640 kilograms). This mass of manure was on a total mass basis, whereas the nitrogen concentration was reported on a dry basis. To convert to a dry basis, the ASAE standard moisture content (14%) of manure was used. These steps are outlined in Equation B-15, resulting in 14.7 kilograms of TKN produced per cow per year (dry basis).

$$\left(0.45\frac{kg\ TKN}{1000\ kg_{Live\ Mass}}\cdot\frac{640\ kg_{Live\ Mass}}{cow}\cdot\frac{12kg_{Total\ Solids}}{86kg_{Total\ Manure}}\right)\cdot\frac{1\ ton}{1\cdot 10^{3}\ kg}=0.00004\frac{tons\ TKN\ Excreted}{cow\cdot day}=14.67\frac{kg\ TKN}{cow\cdot year}\qquad\text{(B-15)}$$

The ASAE standards were be used to directly estimate the amount of ammonia produced per animal. In this standard (ASAE Standard D384.1), 0.079 kilograms of ammonia nitrogen were produced per 1000 kilogram of dairy live animal mass per day (wet basis). Additionally, the average dairy cow was determined to be approximately 640 kilograms in live weight and the average moisture content of manure is 86%. To convert from ammonia nitrogen to ammonia the ammonia nitrogen value is multiplied by the ratio of the molecular weights of ammonia and nitrogen, respectively. The resultant is then multiplied by the ratio of dry manure to total manure (14%, or 0.14). Thus, each day 0.00737 kilograms of ammonia are produced per cow per day. Using this ratio and multiplying by the number of days per year will yield a value of 2.69 kilograms of ammonia per animal per year (dry basis).

ASAE Method 2: ASAE Standards with Dairy Data Collected During August 2002

The amount of total nitrogen was also estimated using physical data collected from the central Texas dairy. Equation B-16 outlines the procedure to estimate the total nitrogen excreted from the dairy on a dry basis. ASAE standards were used for total manure and urine production based on the weighted average size of cow on the dairy. By taking the number and estimated weight of each cow and dividing by the total number of cows, the weighted size is 488 kg. It is estimated that 66.5 kilograms of total nitrogen are produced per cow per year (dry basis).

$$\left(23426\frac{mg\ N}{kg_{Dry\ Manure}}\cdot\frac{29.3\ Kg_{Manure}}{cow\cdot day}\cdot\frac{16.3kg_{Dry\ Manure}}{100Kg_{Manure}}+5552\frac{mg\ N}{Kg_{Urine}}\cdot\frac{12.67Kg_{Urine}}{cow\cdot day}\right)$$

$$\cdot\frac{1\,ton}{1\cdot 10^{9}\ mg}=0.00024\frac{tons\ N\ Excreted}{cow\cdot day}=66.5\frac{kg\ N}{cow\cdot year} \qquad \text{(B-16)}$$

B.5 AMMONIA CONCENTRATION MEASUREMENTS

Only the timeframe from 30-60 minutes is included because this is the time used to determine the average concentration from the GLAS. Applicable notes are made for each sample for problems encountered that might impact the sampling results.

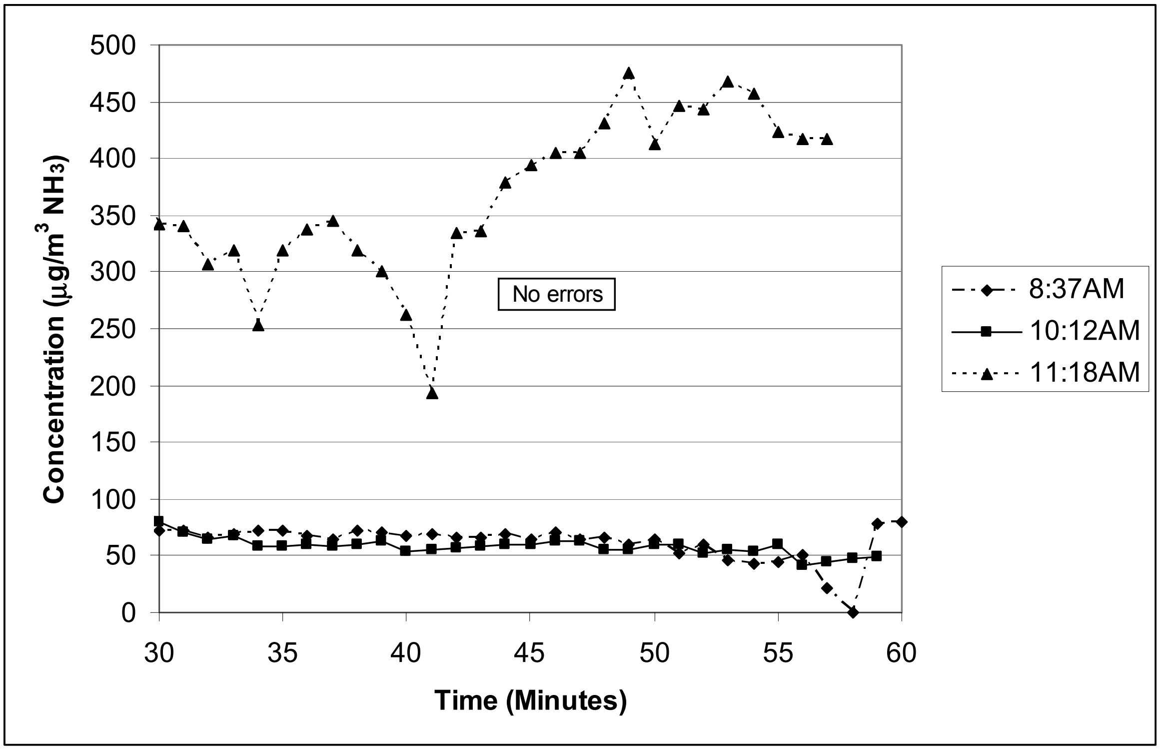

Figure B-4. Summer Unmixed Compost Emission Concentrations.

The unmixed compost was measured throughout the morning. An area approximately one half of the height of the windrows was selected for each measurement. The highest concentration was measured during the middle of the day, or the last measurement made during the morning. No errors were reported during sampling.

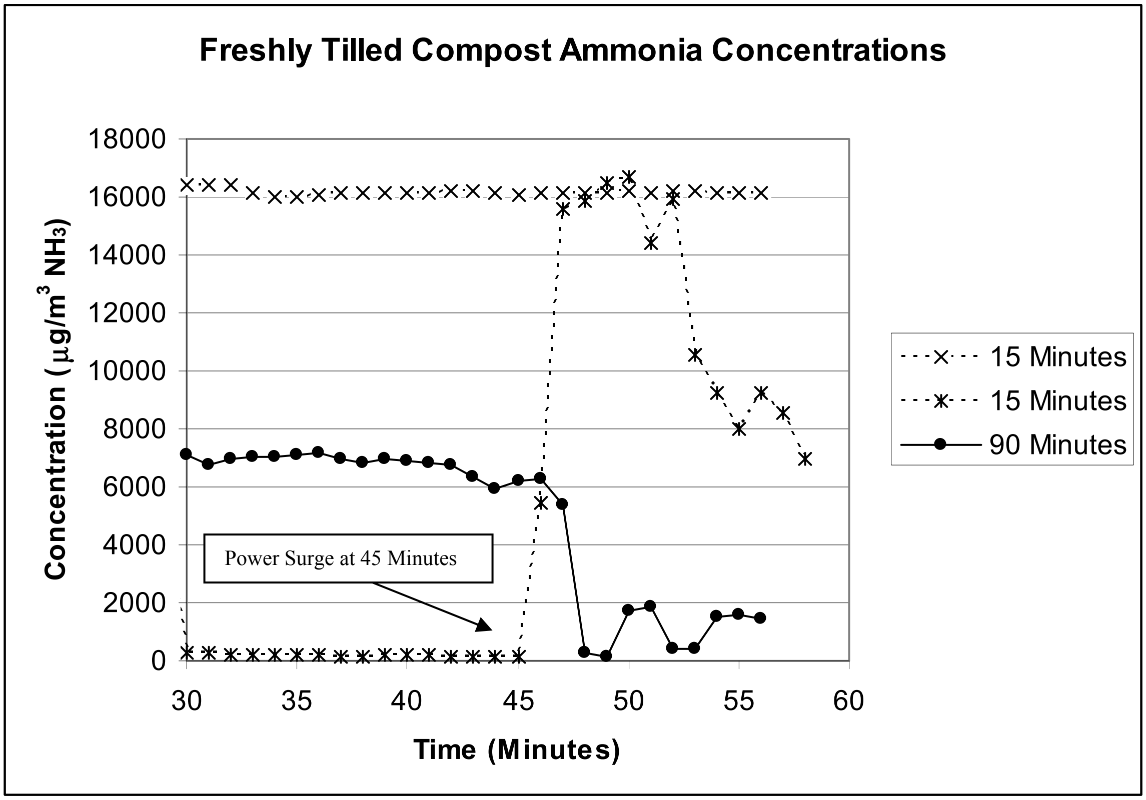

Figure B-5. Summer Mixed Compost Ammonia Emission Concentrations

Two power surges were experienced during the measurement of the mixed compost. Each instance is noted on the graph above. In the first case, the concentration changes from approximately zero to approximately 16,000 micrograms per cubic meter. In the second case, the measurements had not begun from the second thirty minute section of the measurement process.

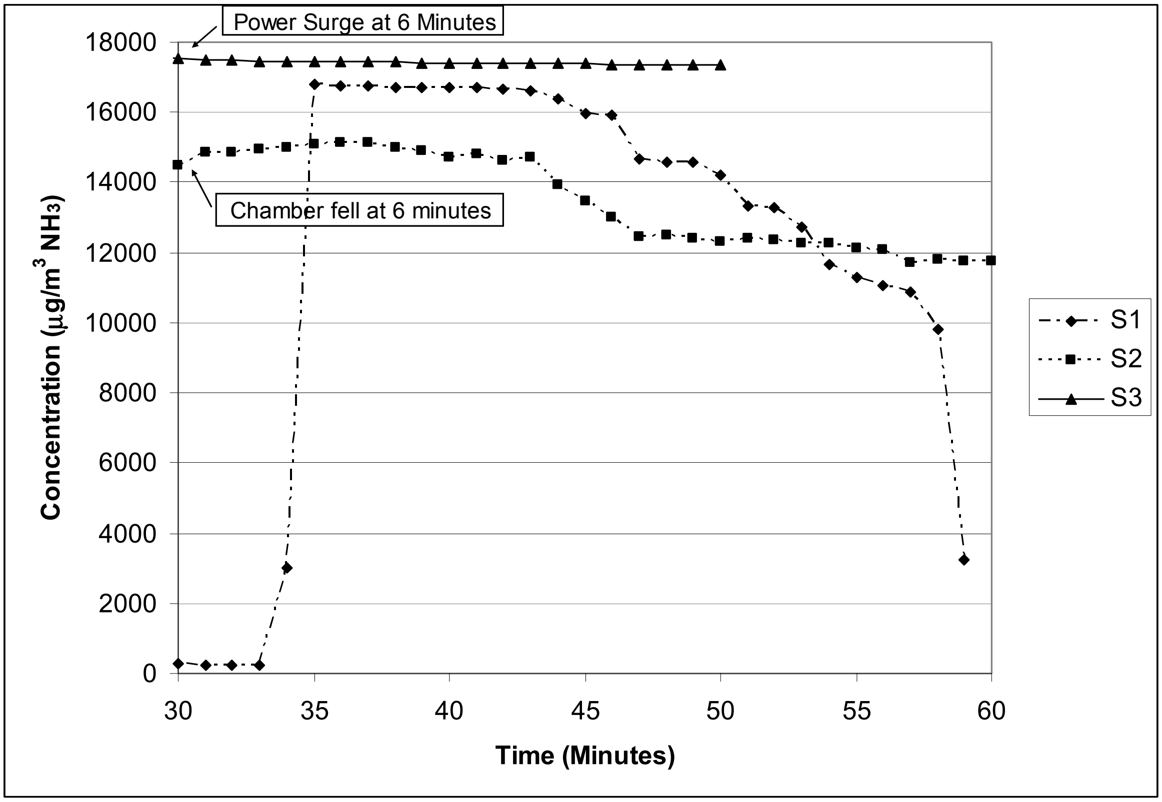

Figure B-6. Summer Separated Solids Ammonia Emission Concentrations

Two errors were reported during the measurement of the separated solids pile. The first occurred when the chamber fell off of the pile after six minutes of measurement. The second error occurred when a power surge occurred from the generator. In each instance the event happened before the thirty minute time frame had expired for purging.

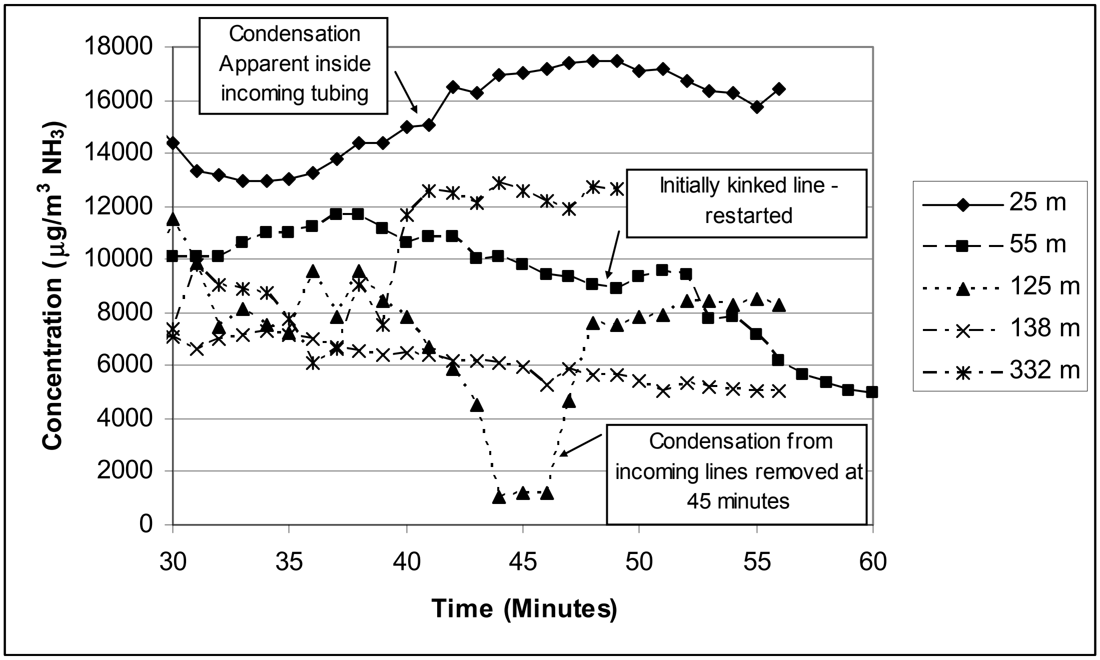

Figure B-7. Summer First Lagoon Ammonia Emission Concentrations

The distances indicated are the length from the sample to the effluent inlet. These samples took place over a liquid surface, and the change in temperature from the zero air contained in compressed cylinders to the liquid surface caused condensation to form in the line returning to the laboratory. The times at which the condensation was discovered are noted on Figure B-7. Compressed air was used to remove any condensation when it was noted. The measurement from 150 feet had a kinked outgoing line that was removed; the experiment was started over.

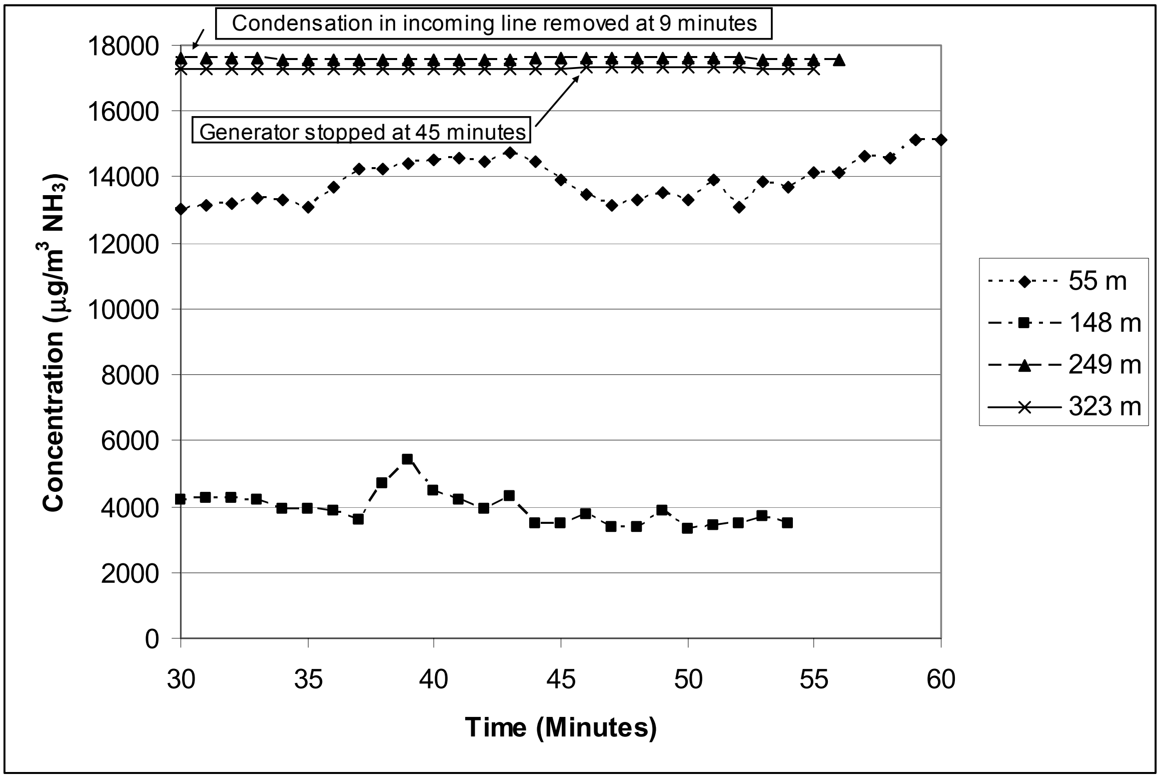

Figure B-8. Summer Second Lagoon Ammonia Emission Concentrations

The distances indicated are the length from the sample to the effluent inlet. More effort was taken to detect condensation and remove it from the line before it was a problem. The time at which the condensation was discovered is noted on Figure B-8. In addition, the generator failed at 45 minutes.

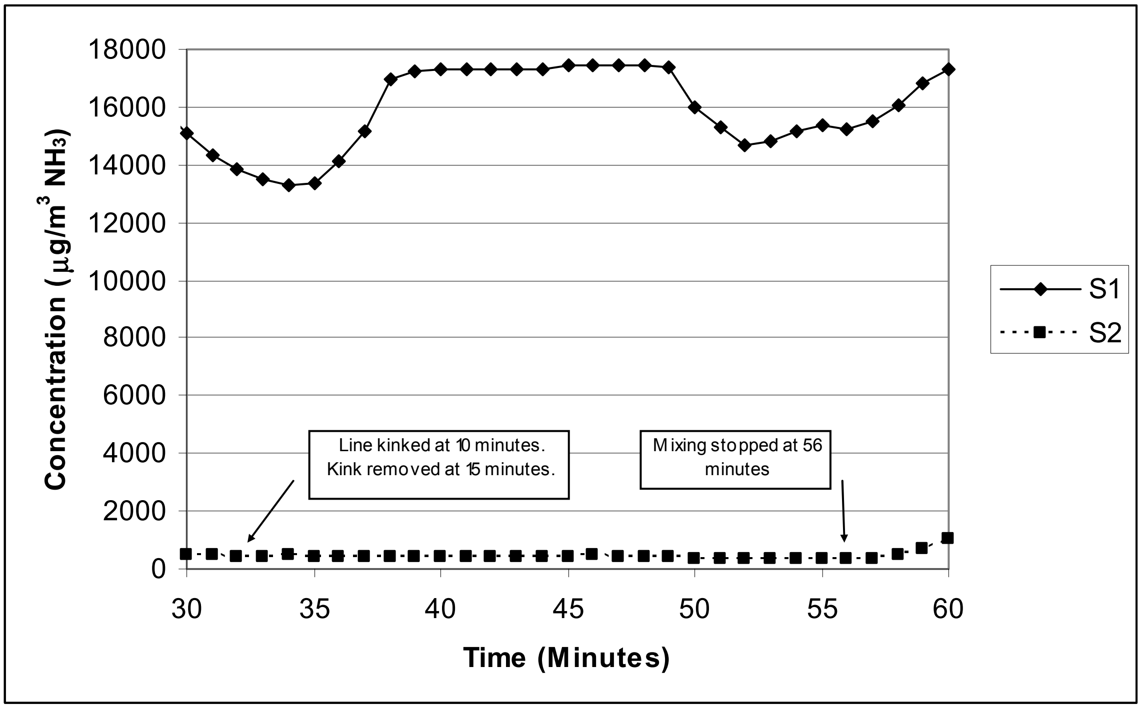

Figure B-9. Summer Mixing Tank Ammonia Emission Concentrations

Only two samples were taken of the mixing tank. The mixing of the tank ceased four minutes before the second measurement could be completed. Also, the tubing connecting the zero grade air and the flux chamber was kinked during the purge time.

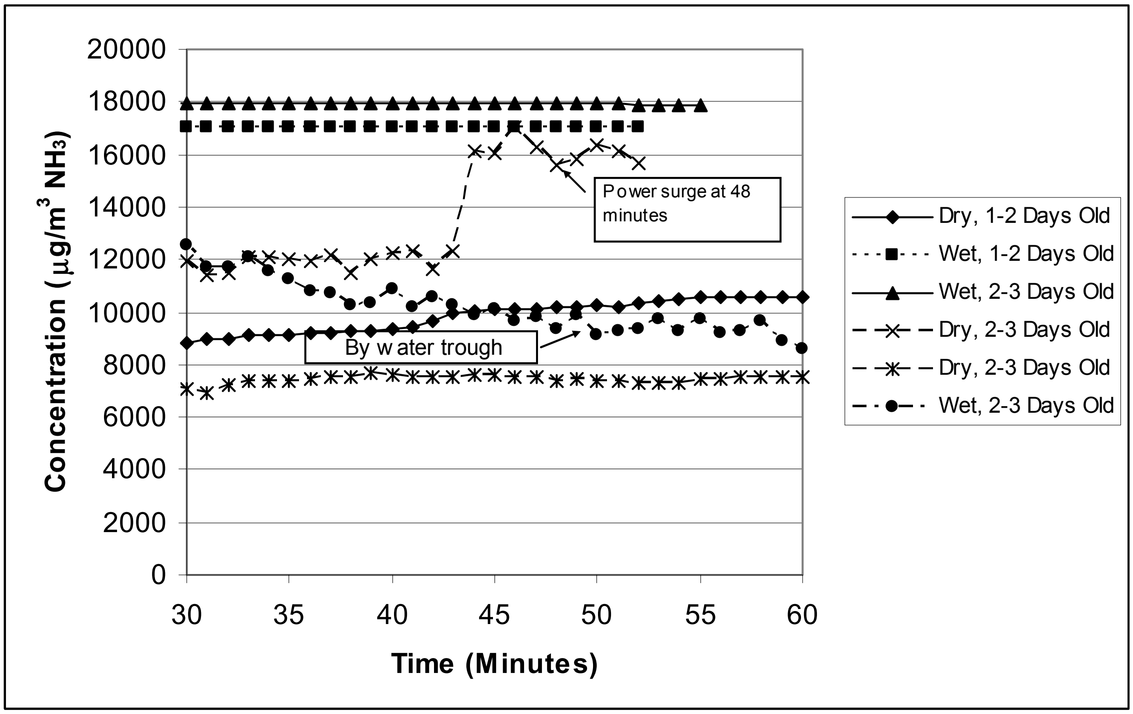

Figure B-10. Summer Open Lot Ammonia Emission Concentrations

The location and condition of each sample is noted in the legend of Figure B-10. One sample, indicated in the figure, was measured by a water trough to examine the affects of the wetting agent – urine, manure, or water. In addition, one power surge was noted at 48 minutes.

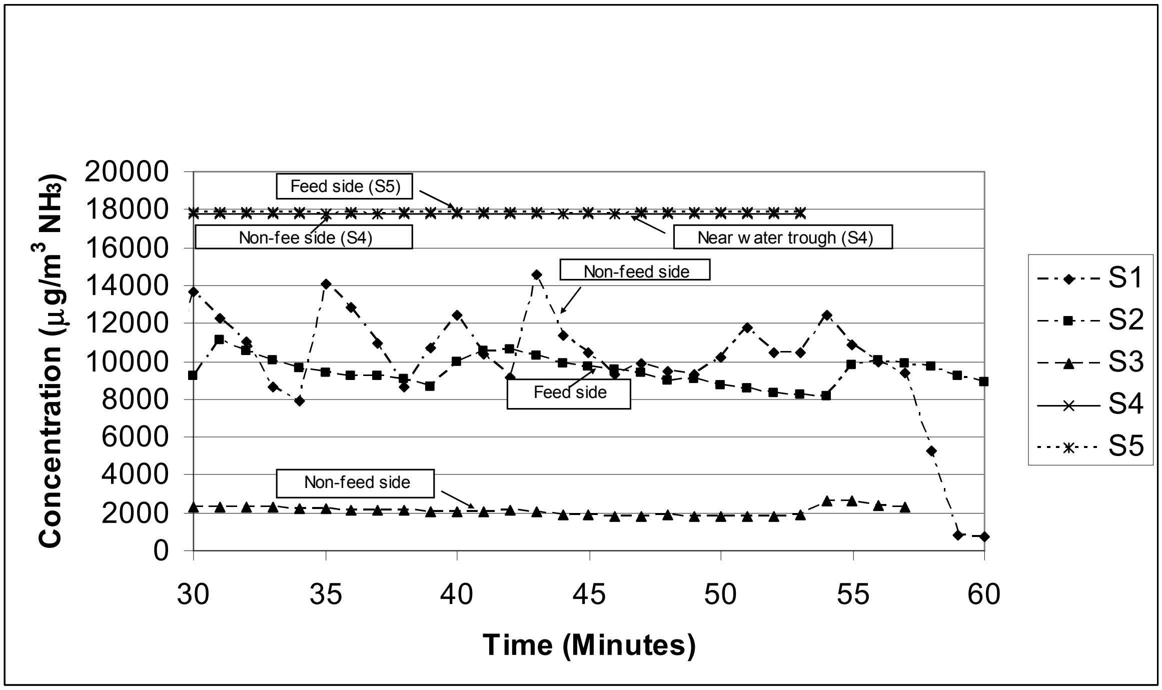

Figure B-11. Summer Free Stall Ammonia Emission Concentrations

Each sample from Figure B-11 increases the amount of loading present as the sample number increases. The location (food or non-feed side) is noted for each sample.

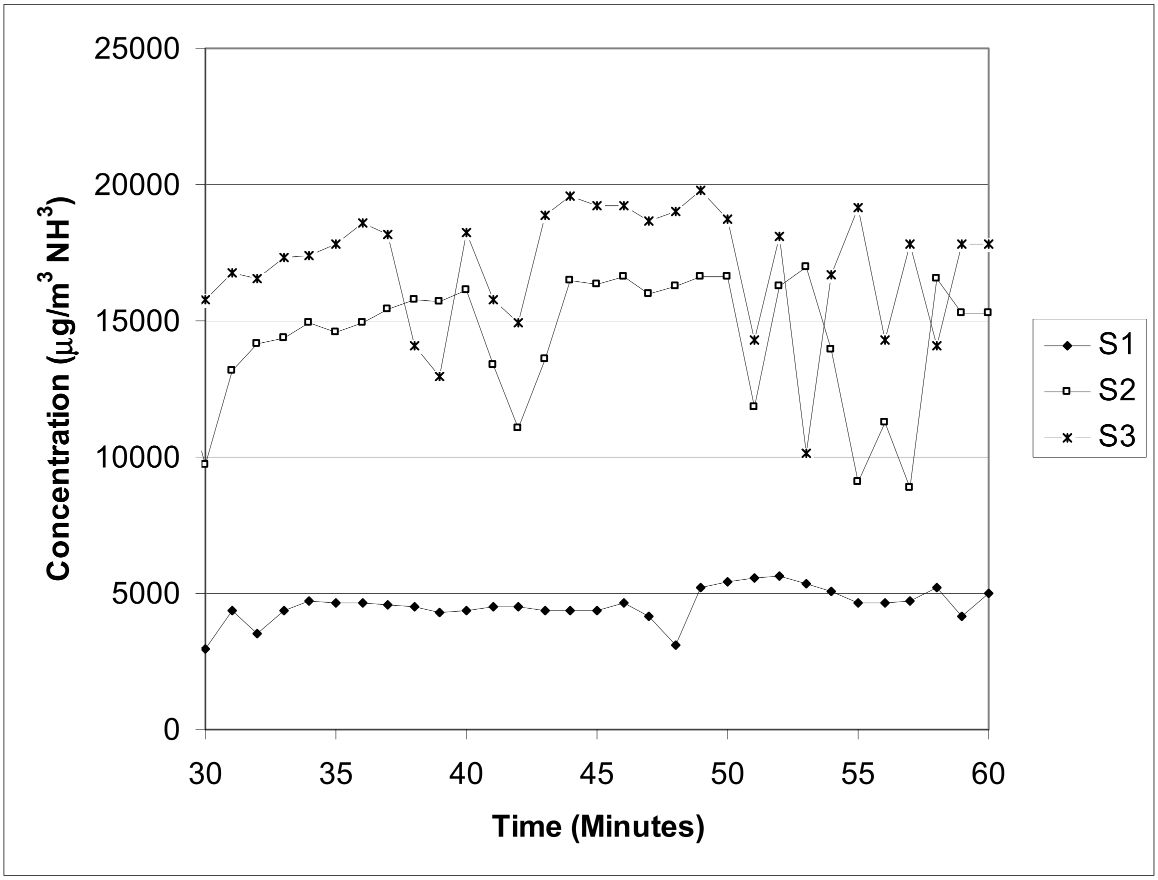

Figure B-12. Winter Compost Ammonia Emission Concentrations.

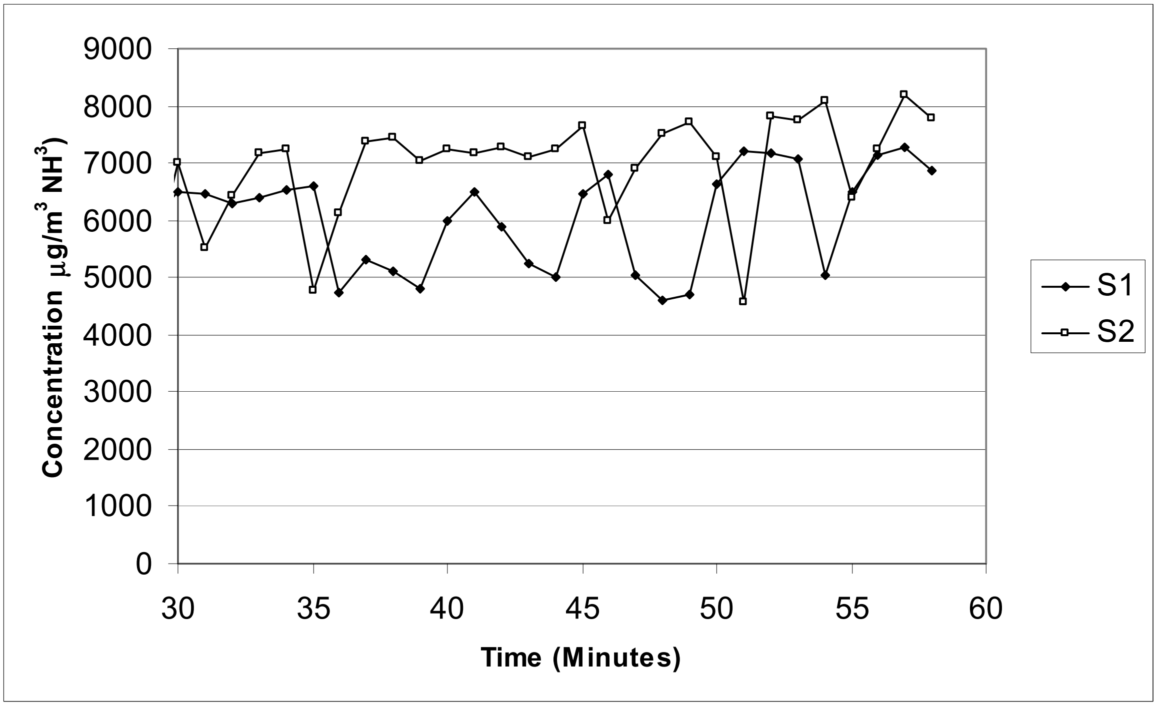

Figure B-13. Winter Separated Solids Ammonia Emission Concentrations.

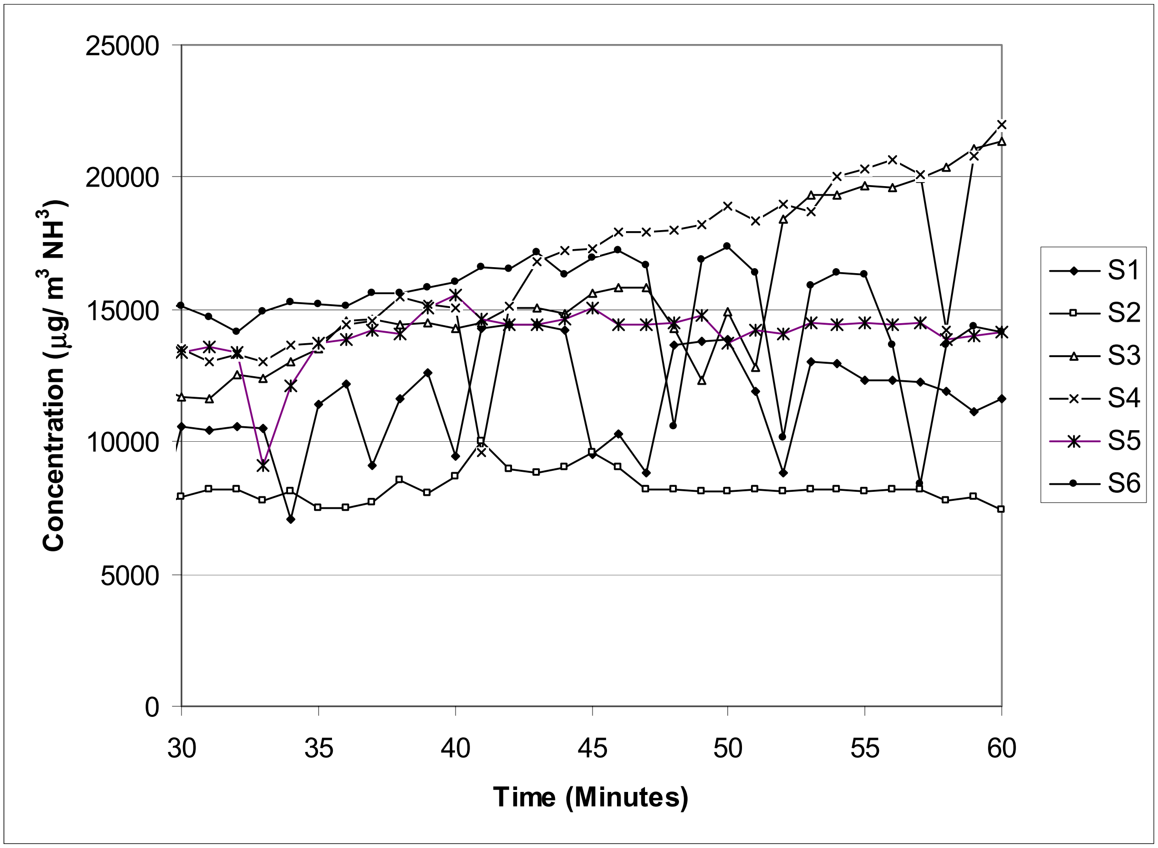

Figure B-14. Winter Lagoon 1 Ammonia Emission Concentrations.

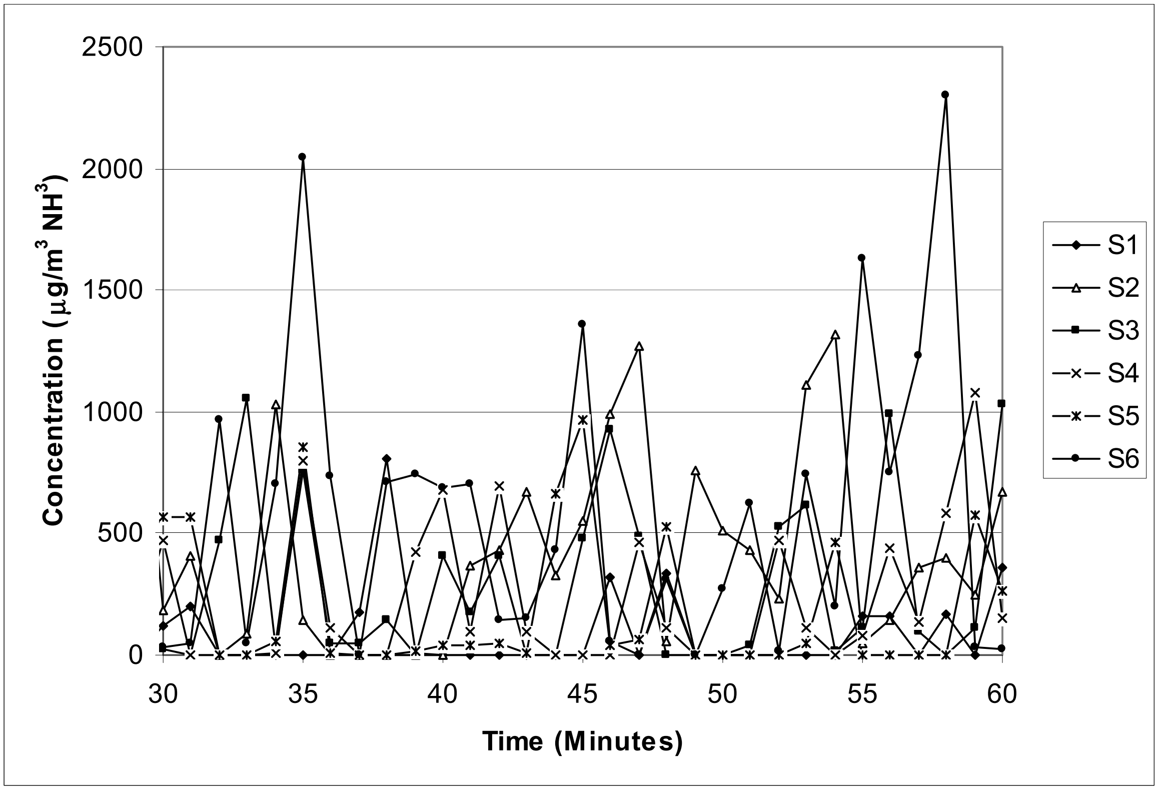

Figure B-15. Winter Lagoon 2 Ammonia Emission Concentrations.

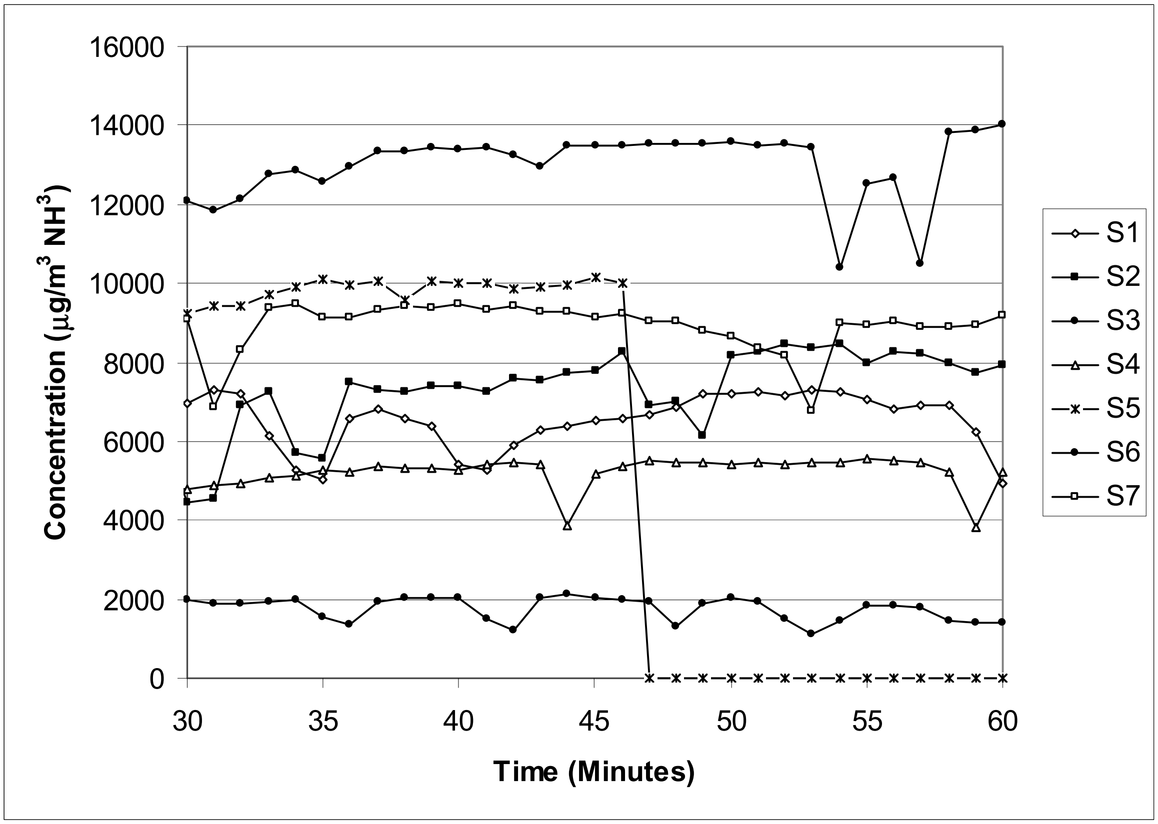

Figure B-16. Winter Open Lot Ammonia Emission Concentrations.

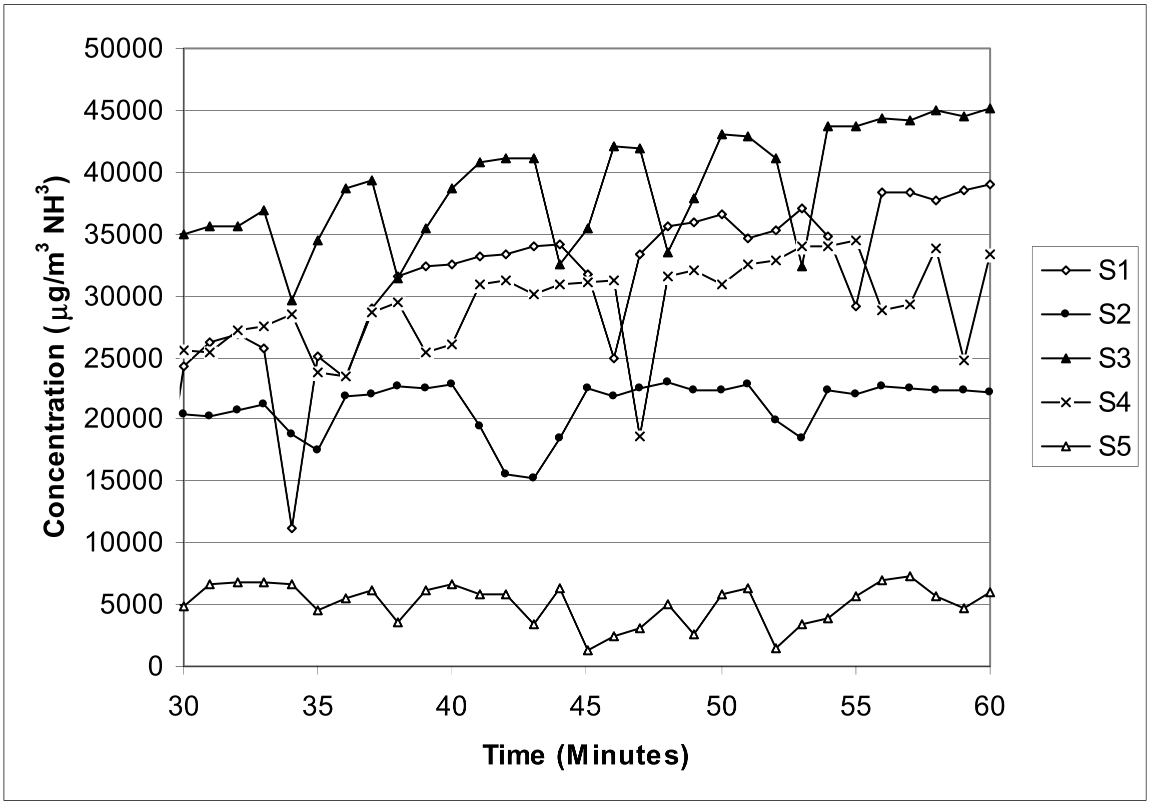

Figure B-17. Winter Free Stall Ammonia Emission Concentrations.

APPENDIX C

C.1 AMMONIA ADSORPTION DATA

The following 96 pages outline the entire set of data points for the adsorption experiments. Each page outlines a different trial, and each trial is divided into columns based on the information recorded. A sample of the headings is indicated below (Figure C-1). The material, temperature, length, concentration, and trial number are located at the upper left corner of the table. The headings for the experiment are (from left to right): the flow rate of zero grade air (in liters per minute – LPM), flow rate of ammonia (NH_3), time in seconds, time in minutes, and concentration of ammonia. The headings are repeated for a second set of columns indicating the final half of the experiment.

Material		Temperature							
Length		Concentration							
Trial									
Air (LPM)	NH3 (LPM)	T (S)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (S)	T (M)	C (PPM)

Figure C-1. Sample Adsorption Data Heading

Material	LDPE	Temperature	80				
Length	50	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	44	4.18
2.00	0.03	1	0.11	1.80	0.19	45	4.18
2.00	0.03	2	0.11	1.80	0.19	46	4.16
2.00	0.03	3	0.11	1.80	0.19	47	4.15
2.00	0.03	4	0.11	1.80	0.19	48	4.15
2.00	0.03	5	0.11	1.80	0.19	49	4.15
2.00	0.03	6	0.11	1.80	0.19	50	4.14
2.00	0.03	7	0.11	1.80	0.19	51	4.13
2.00	0.03	8	0.11	1.80	0.19	52	4.14
2.00	0.03	9	0.11	1.80	0.19	53	4.16
1.80	0.19	10	0.16	1.80	0.19	54	4.14
1.80	0.19	11	0.20	1.80	0.19	56	4.14
1.80	0.19	12	1.44	1.80	0.19	57	4.12
1.80	0.19	13	2.67	1.80	0.19	58	4.09
1.80	0.19	14	4.05	1.80	0.19	59	4.12
1.80	0.19	15	5.43	1.80	0.19	60	4.11
1.80	0.19	16	5.50	1.80	0.18	61	4.14
1.80	0.19	17	5.57	1.80	0.19	62	4.14
1.80	0.19	18	5.38	1.80	0.19	63	4.16
1.80	0.19	19	5.18	1.80	0.19	64	4.17
1.80	0.19	20	5.05	1.80	0.19	65	4.15
1.80	0.19	21	4.92	1.80	0.19	66	4.17
1.80	0.19	22	4.81	1.80	0.19	67	4.16
1.80	0.19	23	4.70	1.80	0.19	68	4.17
1.80	0.19	24	4.65	1.80	0.19	69	4.16
1.80	0.19	25	4.59	1.80	0.19	70	4.18
1.80	0.19	26	4.55	2.00	0.03	71	4.03
1.80	0.19	27	4.50	2.00	0.03	72	3.88
1.80	0.19	28	4.46	2.00	0.03	73	3.01
1.80	0.19	29	4.42	2.00	0.03	74	2.15
1.80	0.19	30	4.40	2.00	0.03	75	1.34
1.80	0.19	31	4.38	2.00	0.03	76	0.54
1.80	0.19	32	4.34	2.00	0.03	77	0.40
1.80	0.19	33	4.31	2.00	0.03	78	0.27
1.80	0.19	34	4.30	2.00	0.03	79	0.24
1.80	0.19	35	4.29	2.00	0.03	80	0.21
1.80	0.19	36	4.27	2.00	0.03	81	0.19
1.80	0.19	37	4.25	2.00	0.03	82	0.18
1.80	0.19	38	4.26	2.00	0.03	83	0.15
1.80	0.19	39	4.26	2.00	0.03	84	0.12
1.80	0.19	40	4.24	2.00	0.03	85	0.12
1.80	0.19	41	4.22	2.00	0.03	86	0.11
1.80	0.19	42	4.20	2.00	0.03	87	0.11
1.80	0.19	43	4.18	2.00	0.03	88	0.11

Material	LDPE	Temperature	80				
Length	50	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.20	46	4.26
2.00	0.03	1	0.11	1.80	0.20	47	4.27
2.00	0.03	2	0.11	1.80	0.20	48	4.26
2.00	0.03	3	0.11	1.80	0.20	49	4.26
2.00	0.03	4	0.11	1.80	0.20	50	4.27
2.00	0.03	5	0.11	1.80	0.20	51	4.28
2.00	0.03	6	0.11	1.80	0.20	52	4.27
2.00	0.03	7	0.11	1.80	0.20	53	4.25
2.00	0.03	8	0.11	1.81	0.19	54	4.26
2.00	0.03	9	0.11	1.80	0.19	55	4.25
1.80	0.20	10	0.43	1.80	0.19	56	4.23
1.80	0.20	11	0.76	1.80	0.19	57	4.25
1.80	0.20	12	2.26	1.80	0.19	58	4.23
1.80	0.20	13	3.77	1.80	0.19	59	4.23
1.80	0.20	14	4.85	1.80	0.19	60	4.21
1.80	0.20	15	5.93	1.80	0.18	61	4.20
1.80	0.20	16	5.75	1.80	0.19	62	4.20
1.80	0.20	17	5.56	1.80	0.19	63	4.21
1.80	0.20	18	5.40	1.80	0.19	64	4.23
1.80	0.20	19	5.25	1.80	0.19	65	4.20
1.80	0.20	20	5.12	1.80	0.18	66	4.23
1.80	0.20	21	4.98	1.80	0.19	67	4.22
1.80	0.20	22	4.91	1.80	0.20	68	4.23
1.80	0.20	23	4.83	1.80	0.19	69	4.21
1.80	0.20	24	4.76	2.00	0.03	70	3.67
1.80	0.20	25	4.70	2.00	0.03	71	3.12
1.80	0.20	26	4.64	2.00	0.03	72	2.20
1.80	0.20	27	4.59	2.00	0.03	73	1.27
1.80	0.20	28	4.55	2.00	0.03	74	0.82
1.80	0.20	29	4.51	2.00	0.03	75	0.36
1.80	0.20	30	4.47	2.00	0.03	76	0.30
1.80	0.20	31	4.43	2.00	0.03	77	0.24
1.80	0.20	32	4.42	2.00	0.03	78	0.21
1.80	0.20	33	4.41	2.00	0.03	79	0.19
1.80	0.20	34	4.38	2.00	0.03	80	0.16
1.80	0.20	35	4.35	2.00	0.03	81	0.14
1.80	0.20	36	4.35	2.00	0.03	82	0.12
1.80	0.20	37	4.35	2.00	0.03	83	0.11
1.80	0.20	38	4.34	2.00	0.03	84	0.11
1.80	0.20	39	4.32	2.00	0.03	85	0.11
1.80	0.20	40	4.31	2.00	0.03	86	0.11
1.80	0.20	41	4.30	2.00	0.03	87	0.11
1.80	0.20	42	4.29	2.00	0.03	88	0.11
1.80	0.20	43	4.29	2.00	0.03	89	0.10
1.80	0.20	44	4.27	2.00	0.03	90	0.10
1.80	0.20	45	4.25	2.00	0.03	91	0.10

Material	LDPE	Temperature	80				
Length	50	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.18	46	4.38
2.00	0.03	1	0.11	1.80	0.18	47	4.37
2.00	0.03	2	0.11	1.80	0.18	48	4.36
2.00	0.03	3	0.11	1.80	0.18	49	4.37
2.00	0.03	4	0.11	1.80	0.18	50	4.38
2.00	0.03	5	0.11	1.80	0.18	51	4.37
2.00	0.03	6	0.11	1.80	0.18	52	4.35
2.00	0.03	7	0.11	1.80	0.18	53	4.35
2.00	0.03	8	0.11	1.80	0.18	54	4.35
2.00	0.03	9	0.12	1.80	0.19	55	4.33
1.80	0.18	10	1.29	1.80	0.18	56	4.30
1.80	0.18	11	2.45	1.80	0.19	57	4.32
1.80	0.18	12	3.92	1.80	0.19	58	4.29
1.80	0.18	13	5.38	1.80	0.19	59	4.30
1.80	0.18	14	5.59	1.80	0.18	60	4.28
1.80	0.18	15	5.80	1.80	0.19	61	4.28
1.80	0.18	16	5.64	1.80	0.18	62	4.28
1.80	0.18	17	5.47	1.80	0.19	63	4.26
1.80	0.18	18	5.31	1.81	0.19	64	4.27
1.80	0.18	19	5.16	1.81	0.18	65	4.26
1.80	0.18	20	5.06	1.80	0.19	66	4.28
1.80	0.18	21	4.95	1.80	0.19	67	4.25
1.80	0.18	22	4.88	1.80	0.19	68	4.26
1.80	0.18	23	4.80	1.80	0.19	69	4.25
1.80	0.18	24	4.76	1.80	0.19	70	3.92
1.80	0.18	25	4.72	2.01	0.03	71	2.22
1.80	0.18	26	4.69	2.01	0.03	72	0.52
1.80	0.18	27	4.66	2.01	0.03	73	0.39
1.80	0.18	28	4.61	2.01	0.03	74	0.26
1.80	0.18	29	4.57	2.01	0.03	75	0.24
1.80	0.18	31	4.56	2.01	0.03	76	0.21
1.80	0.18	32	4.55	2.01	0.03	77	0.18
1.80	0.18	33	4.52	2.01	0.03	78	0.16
1.80	0.18	34	4.49	2.01	0.03	79	0.13
1.80	0.18	35	4.48	2.01	0.03	80	0.11
1.80	0.18	36	4.46	2.01	0.03	81	0.11
1.80	0.18	37	4.45	2.01	0.03	82	0.11
1.80	0.18	38	4.44	2.01	0.03	83	0.11
1.80	0.18	39	4.44	2.01	0.03	84	0.11
1.80	0.18	40	4.44	2.01	0.03	85	0.11
1.80	0.18	41	4.43	2.01	0.03	86	0.11
1.80	0.18	42	4.42	2.01	0.03	87	0.10
1.80	0.18	43	4.40	2.01	0.03	88	0.10
1.80	0.18	44	4.38	2.01	0.03	89	0.10
1.80	0.18	45	4.38	2.01	0.03	90	0.10

Material	LDPE	Temperature	80				
Length	150	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.01	0.04	0	0.10	1.80	0.19	46	3.10
2.01	0.04	1	0.10	1.80	0.19	47	3.12
2.01	0.04	2	0.10	1.80	0.19	48	3.14
2.01	0.04	3	0.10	1.80	0.19	49	3.15
2.01	0.04	4	0.10	1.80	0.19	50	3.16
2.01	0.04	5	0.10	1.80	0.19	51	3.16
2.01	0.04	6	0.10	1.80	0.19	52	3.15
2.01	0.04	7	0.10	1.80	0.19	53	3.17
2.01	0.04	8	0.10	1.80	0.19	54	3.18
2.01	0.04	9	0.10	1.80	0.19	55	3.17
1.80	0.19	10	0.72	1.80	0.19	56	3.19
1.80	0.19	11	1.34	1.80	0.19	57	3.18
1.80	0.19	12	2.07	1.80	0.19	58	3.23
1.80	0.19	13	2.80	1.80	0.19	59	3.24
1.80	0.19	14	2.94	1.80	0.18	60	3.23
1.80	0.19	15	3.09	1.81	0.18	61	3.26
1.80	0.19	16	3.04	1.80	0.19	62	3.24
1.80	0.19	17	2.99	1.80	0.19	63	3.26
1.80	0.19	18	2.95	1.81	0.18	64	3.25
1.80	0.19	19	2.91	1.80	0.20	65	3.26
1.80	0.19	20	2.90	1.80	0.19	66	3.27
1.80	0.19	21	2.88	1.80	0.19	67	3.27
1.80	0.19	22	2.87	1.80	0.19	68	3.29
1.80	0.19	23	2.86	1.80	0.19	69	3.29
1.80	0.19	24	2.88	1.80	0.19	70	3.02
1.80	0.19	25	2.89	2.00	0.03	71	2.33
1.80	0.19	26	2.89	2.00	0.03	72	1.64
1.80	0.19	27	2.89	2.00	0.03	73	1.03
1.80	0.19	28	2.91	2.00	0.03	74	0.41
1.80	0.19	29	2.93	2.00	0.03	75	0.32
1.80	0.19	30	2.94	2.00	0.03	76	0.24
1.80	0.19	31	2.95	2.00	0.03	77	0.21
1.80	0.19	32	2.97	2.00	0.03	78	0.19
1.80	0.19	33	2.98	2.00	0.03	79	0.16
1.80	0.19	34	3.00	2.00	0.03	80	0.14
1.80	0.19	35	3.02	2.00	0.03	81	0.12
1.80	0.19	36	3.03	2.00	0.03	82	0.11
1.80	0.19	37	3.04	2.00	0.03	83	0.11
1.80	0.19	38	3.05	2.00	0.03	84	0.11
1.80	0.19	39	3.06	2.00	0.03	85	0.11
1.80	0.19	40	3.06	2.00	0.03	86	0.11
1.80	0.19	41	3.07	2.00	0.03	87	0.08
1.80	0.19	42	3.08	2.00	0.03	88	0.05
1.80	0.19	43	3.10	2.00	0.03	89	0.05
1.80	0.19	45	3.10	2.00	0.03	90	0.05

Material	LDPE	Temperature	80				
Length	150	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	45	3.62
2.00	0.03	1	0.11	1.80	0.19	47	3.63
2.00	0.03	2	0.11	1.80	0.19	48	3.63
2.00	0.03	3	0.11	1.80	0.19	49	3.61
2.00	0.03	4	0.11	1.80	0.19	50	3.59
2.00	0.03	5	0.11	1.80	0.19	51	3.59
2.00	0.03	6	0.11	1.80	0.19	52	3.58
2.00	0.03	7	0.11	1.80	0.19	53	3.58
2.00	0.03	8	0.11	1.80	0.19	54	3.57
2.00	0.03	9	0.11	1.80	0.19	55	3.58
1.80	0.19	10	0.19	1.80	0.19	56	3.59
1.80	0.19	11	0.28	1.80	0.19	57	3.57
1.80	0.19	12	1.43	1.80	0.19	58	3.61
1.80	0.19	13	2.57	1.81	0.19	59	3.59
1.80	0.19	14	3.69	1.80	0.19	60	3.61
1.80	0.19	15	4.82	1.80	0.19	61	3.60
1.80	0.19	16	4.80	1.80	0.19	62	3.58
1.80	0.19	17	4.78	1.80	0.19	63	3.59
1.80	0.19	18	4.65	1.80	0.18	64	3.58
1.80	0.19	19	4.51	1.80	0.19	65	3.61
1.80	0.19	20	4.38	1.80	0.19	66	3.59
1.80	0.19	21	4.25	1.80	0.18	67	3.62
1.80	0.19	22	4.17	1.80	0.19	68	3.61
1.80	0.19	23	4.09	1.80	0.18	69	3.61
1.80	0.19	24	4.03	1.80	0.19	70	3.63
1.80	0.19	25	3.98	2.00	0.03	71	3.38
1.80	0.19	26	3.93	2.00	0.03	72	3.13
1.80	0.19	27	3.88	2.00	0.03	73	2.35
1.80	0.19	28	3.85	2.00	0.03	74	1.58
1.80	0.19	29	3.82	2.00	0.03	75	0.98
1.80	0.19	30	3.79	2.00	0.03	76	0.38
1.80	0.19	31	3.76	2.00	0.03	77	0.31
1.80	0.19	32	3.75	2.00	0.03	78	0.23
1.80	0.19	33	3.75	2.00	0.03	79	0.20
1.80	0.19	34	3.72	2.00	0.03	80	0.18
1.80	0.19	35	3.69	2.00	0.03	81	0.15
1.80	0.19	36	3.68	2.00	0.03	82	0.13
1.80	0.19	37	3.68	2.00	0.03	83	0.12
1.80	0.19	38	3.67	2.00	0.03	84	0.11
1.80	0.19	39	3.66	2.00	0.03	85	0.11
1.80	0.19	40	3.66	2.00	0.03	86	0.11
1.80	0.19	41	3.65	2.00	0.03	87	0.11
1.80	0.19	42	3.65	2.00	0.03	88	0.10
1.80	0.19	43	3.64	2.00	0.03	89	0.10
1.80	0.19	44	3.63	2.00	0.03	89	0.10

Material	LDPE	Temperature	80				
Length	50	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	46	3.78
2.00	0.03	1	0.11	1.80	0.19	47	3.77
2.00	0.03	2	0.11	1.80	0.19	48	3.76
2.00	0.03	3	0.11	1.80	0.19	49	3.76
2.00	0.03	4	0.11	1.80	0.19	50	3.76
2.00	0.03	5	0.11	1.80	0.19	51	3.75
2.00	0.03	6	0.11	1.80	0.19	52	3.75
2.00	0.03	7	0.11	1.80	0.19	53	3.76
2.00	0.03	8	0.11	1.80	0.19	54	3.77
2.00	0.03	9	0.11	1.80	0.19	55	3.75
1.80	0.19	10	0.15	1.80	0.19	56	3.76
1.80	0.19	11	0.20	1.80	0.19	57	3.76
1.80	0.19	12	1.30	1.80	0.19	58	3.75
1.80	0.19	13	2.41	1.81	0.19	59	3.77
1.80	0.19	14	3.68	1.80	0.19	60	3.75
1.80	0.19	15	4.95	1.80	0.19	61	3.76
1.80	0.19	16	5.04	1.80	0.18	62	3.74
1.80	0.19	17	5.12	1.80	0.19	63	3.75
1.80	0.19	18	4.94	1.80	0.18	64	3.75
1.80	0.19	19	4.76	1.80	0.19	65	3.74
1.80	0.19	20	4.64	1.80	0.19	66	3.74
1.80	0.19	21	4.52	1.80	0.19	67	3.71
1.80	0.19	22	4.43	1.80	0.19	68	3.74
1.80	0.19	23	4.33	1.80	0.19	69	3.73
1.80	0.19	24	4.28	1.80	0.19	70	3.75
1.80	0.19	25	4.23	2.00	0.03	71	3.56
1.80	0.19	26	4.17	2.00	0.03	72	3.38
1.80	0.19	27	4.10	2.00	0.03	73	2.58
1.80	0.19	28	4.08	2.00	0.03	74	1.79
1.80	0.19	29	4.05	2.00	0.03	75	1.12
1.80	0.19	30	4.01	2.00	0.03	76	0.45
1.80	0.19	31	3.98	2.00	0.03	77	0.35
1.80	0.19	32	3.95	2.00	0.03	78	0.24
1.80	0.19	33	3.92	2.00	0.03	79	0.23
1.80	0.19	34	3.92	2.00	0.03	80	0.21
1.80	0.19	36	3.92	2.00	0.03	81	0.18
1.80	0.19	37	3.89	2.00	0.03	82	0.15
1.80	0.19	38	3.85	2.00	0.03	83	0.13
1.80	0.19	39	3.85	2.00	0.03	84	0.11
1.80	0.19	40	3.84	2.00	0.03	85	0.11
1.80	0.19	41	3.82	2.00	0.03	86	0.11
1.80	0.19	42	3.79	2.00	0.03	87	0.11
1.80	0.19	43	3.79	2.00	0.03	88	0.11
1.80	0.19	44	3.78	2.00	0.03	89	0.11
1.80	0.19	45	3.78	2.00	0.03	90	0.11

Material	LDPE	Temperature	80				
Length	50	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	12.29
1.99	0.03	1	0.11	1.40	0.59	47	12.31
1.99	0.03	2	0.11	1.40	0.59	48	12.32
1.99	0.03	3	0.11	1.40	0.59	49	12.29
1.99	0.03	4	0.11	1.40	0.59	50	12.25
1.99	0.03	5	0.11	1.40	0.59	51	12.29
1.99	0.03	6	0.11	1.40	0.59	52	12.32
1.99	0.03	7	0.11	1.40	0.59	53	12.29
1.99	0.03	8	0.11	1.40	0.59	54	12.25
1.99	0.03	9	0.11	1.39	0.59	55	12.27
1.40	0.59	10	2.03	1.39	0.59	56	12.26
1.40	0.59	11	3.96	1.40	0.59	57	12.22
1.40	0.59	12	7.43	1.39	0.59	58	12.26
1.40	0.59	13	10.91	1.40	0.59	59	12.19
1.40	0.59	14	12.31	1.39	0.59	60	12.28
1.40	0.59	15	13.71	1.39	0.59	61	12.24
1.40	0.59	16	13.55	1.39	0.59	62	12.26
1.40	0.59	17	13.39	1.39	0.59	63	12.23
1.40	0.59	18	13.29	1.40	0.59	64	12.23
1.40	0.59	19	13.19	1.40	0.59	65	12.27
1.40	0.59	20	13.07	1.39	0.59	66	12.22
1.40	0.59	21	12.95	1.40	0.59	67	12.28
1.40	0.59	22	12.91	1.39	0.59	68	12.21
1.40	0.59	23	12.88	1.40	0.59	69	12.28
1.40	0.59	24	12.80	1.39	0.59	70	12.29
1.40	0.59	25	12.71	1.99	0.03	71	11.44
1.40	0.59	26	12.68	1.99	0.03	72	10.59
1.40	0.59	27	12.65	1.99	0.03	73	7.74
1.40	0.59	28	12.61	1.99	0.03	74	4.88
1.40	0.59	30	12.57	1.99	0.03	75	2.73
1.40	0.59	31	12.53	1.99	0.03	76	0.57
1.40	0.59	32	12.50	1.99	0.03	77	0.46
1.40	0.59	33	12.50	1.99	0.03	78	0.35
1.40	0.59	34	12.51	1.99	0.03	79	0.31
1.40	0.59	35	12.46	1.99	0.03	80	0.26
1.40	0.59	36	12.42	1.99	0.03	81	0.23
1.40	0.59	37	12.43	1.99	0.03	82	0.21
1.40	0.59	38	12.44	1.99	0.03	83	0.21
1.40	0.59	39	12.39	1.99	0.03	84	0.21
1.40	0.59	40	12.34	1.99	0.03	85	0.20
1.40	0.59	41	12.35	1.99	0.03	86	0.20
1.40	0.59	42	12.36	1.99	0.03	87	0.17
1.40	0.59	43	12.34	1.99	0.03	89	0.15
1.40	0.59	44	12.33	1.99	0.03	90	0.15
1.40	0.59	45	12.31	1.99	0.03	91	0.15

Material	LDPE	Temperature	80				
Length	50	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	12.61
1.99	0.03	1	0.11	1.40	0.59	47	12.62
1.99	0.03	2	0.11	1.40	0.59	48	12.63
1.99	0.03	3	0.11	1.40	0.59	49	12.63
1.99	0.03	4	0.11	1.40	0.59	50	12.63
1.99	0.03	5	0.11	1.40	0.59	51	12.62
1.99	0.03	6	0.11	1.40	0.59	52	12.61
1.99	0.03	7	0.11	1.40	0.59	53	12.64
1.99	0.03	8	0.11	1.40	0.59	54	12.67
1.99	0.03	9	0.11	1.40	0.59	55	12.60
1.40	0.59	10	1.90	1.39	0.59	56	12.66
1.40	0.59	11	3.69	1.40	0.59	57	12.60
1.40	0.59	12	7.15	1.39	0.59	58	12.61
1.40	0.59	13	10.62	1.40	0.60	59	12.62
1.40	0.59	14	12.27	1.40	0.60	60	12.62
1.40	0.59	15	13.92	1.39	0.59	61	12.68
1.40	0.59	16	13.76	1.40	0.59	62	12.60
1.40	0.59	17	13.60	1.40	0.60	63	12.66
1.40	0.59	18	13.49	1.40	0.59	64	12.62
1.40	0.59	19	13.39	1.39	0.59	65	12.65
1.40	0.59	20	13.32	1.39	0.59	66	12.67
1.40	0.59	21	13.24	1.40	0.59	67	12.66
1.40	0.59	22	13.17	1.39	0.60	68	12.71
1.40	0.59	23	13.09	1.39	0.59	69	12.66
1.40	0.59	24	13.07	1.40	0.59	70	12.70
1.40	0.59	25	13.05	1.99	0.03	71	11.86
1.40	0.59	26	12.97	1.99	0.03	72	11.02
1.40	0.59	27	12.89	1.99	0.03	73	8.05
1.40	0.59	28	12.89	1.99	0.03	74	5.09
1.40	0.59	29	12.90	1.99	0.03	75	2.86
1.40	0.59	30	12.86	1.99	0.03	76	0.64
1.40	0.59	31	12.82	1.99	0.03	77	0.51
1.40	0.59	32	12.80	1.99	0.03	78	0.37
1.40	0.59	33	12.78	1.99	0.03	79	0.31
1.40	0.59	34	12.77	1.99	0.03	80	0.26
1.40	0.59	35	12.75	1.99	0.03	81	0.24
1.40	0.59	36	12.72	1.99	0.03	82	0.21
1.40	0.59	37	12.68	1.99	0.03	83	0.21
1.40	0.59	38	12.71	1.99	0.03	84	0.21
1.40	0.59	39	12.74	1.99	0.03	85	0.21
1.40	0.59	40	12.69	1.99	0.03	86	0.21
1.40	0.59	41	12.65	1.99	0.03	87	0.20
1.40	0.59	42	12.66	1.99	0.03	88	0.18
1.40	0.59	43	12.67	1.99	0.03	89	0.18
1.40	0.59	45	12.64	1.99	0.03	90	0.18

Material	LDPE	Temperature	80				
Length	50	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	45	13.10
1.99	0.03	1	0.11	1.40	0.59	47	13.07
1.99	0.03	2	0.11	1.40	0.59	48	13.04
1.99	0.03	3	0.11	1.40	0.59	49	13.07
1.99	0.03	4	0.11	1.40	0.59	50	13.10
1.99	0.03	5	0.11	1.40	0.59	51	13.09
1.99	0.03	6	0.11	1.40	0.59	52	13.09
1.99	0.03	7	0.11	1.40	0.59	53	13.09
1.99	0.03	8	0.11	1.40	0.59	54	13.09
1.99	0.03	9	0.11	1.40	0.59	55	13.08
1.40	0.59	10	2.18	1.40	0.59	56	13.02
1.40	0.59	11	4.25	1.40	0.59	57	13.07
1.40	0.59	12	7.80	1.39	0.59	58	13.00
1.40	0.59	13	11.36	1.39	0.60	59	13.06
1.40	0.59	14	12.80	1.40	0.59	60	13.04
1.40	0.59	15	14.24	1.40	0.60	61	13.06
1.40	0.59	16	14.15	1.40	0.59	62	13.08
1.40	0.59	17	14.05	1.40	0.59	63	13.03
1.40	0.59	18	13.92	1.40	0.59	64	13.08
1.40	0.59	19	13.78	1.39	0.59	65	13.04
1.40	0.59	20	13.71	1.40	0.59	66	13.13
1.40	0.59	21	13.64	1.39	0.59	67	13.10
1.40	0.59	22	13.57	1.39	0.59	68	13.11
1.40	0.59	23	13.50	1.40	0.59	69	13.13
1.40	0.59	24	13.44	1.40	0.59	70	13.09
1.40	0.59	25	13.39	1.99	0.03	71	12.09
1.40	0.59	26	13.37	1.99	0.03	72	11.09
1.40	0.59	27	13.35	1.99	0.03	73	8.00
1.40	0.59	28	13.30	1.99	0.03	74	4.92
1.40	0.59	29	13.26	1.99	0.03	75	2.78
1.40	0.59	30	13.27	1.99	0.03	76	0.63
1.40	0.59	31	13.29	1.99	0.03	77	0.50
1.40	0.59	32	13.22	1.99	0.03	78	0.37
1.40	0.59	33	13.15	1.99	0.03	79	0.32
1.40	0.59	34	13.16	1.99	0.03	80	0.28
1.40	0.59	35	13.17	1.99	0.03	81	0.25
1.40	0.59	36	13.15	1.99	0.03	82	0.23
1.40	0.59	37	13.13	1.99	0.03	83	0.22
1.40	0.59	38	13.12	1.99	0.03	84	0.21
1.40	0.59	39	13.10	1.99	0.03	85	0.21
1.40	0.59	40	13.12	1.99	0.03	86	0.21
1.40	0.59	41	13.13	1.99	0.03	87	0.20
1.40	0.59	42	13.09	1.99	0.03	88	0.19
1.40	0.59	43	13.06	1.99	0.03	89	0.19
1.40	0.59	44	13.08	1.99	0.03	89	0.19

Material	LDPE	Temperature	80				
Length	150	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.39	0.59	46	11.71
1.99	0.03	1	0.11	1.39	0.59	47	11.67
1.99	0.03	2	0.11	1.39	0.59	48	11.63
1.99	0.03	3	0.11	1.39	0.59	49	11.64
1.99	0.03	4	0.11	1.39	0.59	50	11.66
1.99	0.03	5	0.11	1.39	0.59	51	11.65
1.99	0.03	6	0.11	1.39	0.59	52	11.65
1.99	0.03	7	0.11	1.39	0.59	53	11.64
1.99	0.03	8	0.11	1.39	0.59	54	11.64
1.99	0.03	9	0.11	1.39	0.59	55	11.67
1.39	0.59	10	1.27	1.39	0.59	56	11.61
1.39	0.59	11	2.44	1.40	0.59	57	11.69
1.39	0.59	12	5.83	1.39	0.59	58	11.65
1.39	0.59	13	9.23	1.40	0.59	59	11.70
1.39	0.59	14	10.92	1.39	0.59	60	11.69
1.39	0.59	15	12.60	1.40	0.59	61	11.67
1.39	0.59	16	12.55	1.40	0.59	62	11.71
1.39	0.59	17	12.50	1.40	0.59	63	11.67
1.39	0.59	18	12.39	1.40	0.60	64	11.74
1.39	0.59	19	12.27	1.39	0.59	65	11.69
1.39	0.59	20	12.21	1.40	0.59	66	11.73
1.39	0.59	21	12.14	1.40	0.59	67	11.73
1.39	0.59	22	12.09	1.39	0.59	68	11.74
1.39	0.59	23	12.05	1.40	0.59	69	11.75
1.39	0.59	24	12.00	1.40	0.59	70	11.69
1.39	0.59	25	11.94	1.99	0.03	71	10.94
1.39	0.59	26	11.95	1.99	0.03	72	10.18
1.39	0.59	27	11.96	1.99	0.03	73	7.24
1.39	0.59	28	11.90	1.99	0.03	74	4.31
1.39	0.59	29	11.84	1.99	0.03	75	2.52
1.39	0.59	30	11.84	1.99	0.03	76	0.73
1.39	0.59	31	11.84	1.99	0.03	77	0.56
1.39	0.59	32	11.79	1.99	0.03	78	0.39
1.39	0.59	33	11.74	1.99	0.03	79	0.35
1.39	0.59	34	11.74	1.99	0.03	80	0.30
1.39	0.59	35	11.74	1.99	0.03	81	0.27
1.39	0.59	36	11.73	1.99	0.03	82	0.24
1.39	0.59	37	11.72	1.99	0.03	83	0.23
1.39	0.59	38	11.71	1.99	0.03	84	0.21
1.39	0.59	39	11.69	1.99	0.03	85	0.21
1.39	0.59	40	11.71	1.99	0.03	86	0.21
1.39	0.59	41	11.72	1.99	0.03	87	0.21
1.39	0.59	42	11.69	1.99	0.03	88	0.21
1.39	0.59	43	11.65	1.99	0.03	89	0.21
1.39	0.59	45	11.68	1.99	0.03	90	0.21

Material	LDPE	Temperature	80				
Length	150	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	11.42
1.99	0.03	1	0.11	1.40	0.59	47	11.41
1.99	0.03	2	0.11	1.40	0.59	48	11.41
1.99	0.03	3	0.11	1.40	0.59	49	11.42
1.99	0.03	4	0.11	1.40	0.59	50	11.43
1.99	0.03	5	0.11	1.40	0.59	51	11.41
1.99	0.03	6	0.11	1.40	0.59	52	11.38
1.99	0.03	7	0.11	1.40	0.59	53	11.41
1.99	0.03	8	0.11	1.40	0.59	54	11.44
1.99	0.03	9	0.11	1.40	0.59	55	11.37
1.40	0.59	10	1.18	1.40	0.59	56	11.40
1.40	0.59	11	2.25	1.40	0.60	57	11.38
1.40	0.59	12	5.53	1.40	0.60	58	11.39
1.40	0.59	13	8.82	1.39	0.59	59	11.41
1.40	0.59	14	10.57	1.40	0.59	60	11.36
1.40	0.59	15	12.32	1.40	0.59	61	11.42
1.40	0.59	16	12.24	1.39	0.59	62	11.35
1.40	0.59	17	12.16	1.39	0.59	63	11.41
1.40	0.59	18	12.08	1.40	0.59	64	11.41
1.40	0.59	19	12.01	1.39	0.59	65	11.42
1.40	0.59	20	11.96	1.39	0.59	66	11.47
1.40	0.59	21	11.91	1.40	0.59	67	11.41
1.40	0.59	22	11.83	1.40	0.59	68	11.49
1.40	0.59	23	11.75	1.40	0.59	69	11.43
1.40	0.59	24	11.74	1.39	0.59	70	11.48
1.40	0.59	25	11.73	1.99	0.03	71	10.66
1.40	0.59	26	11.67	1.99	0.03	72	9.84
1.40	0.59	27	11.62	1.99	0.03	73	6.92
1.40	0.59	28	11.61	1.99	0.03	74	4.00
1.40	0.59	29	11.61	1.99	0.03	75	2.34
1.40	0.59	31	11.57	1.99	0.03	76	0.68
1.40	0.59	32	11.54	1.99	0.03	77	0.53
1.40	0.59	33	11.53	1.99	0.03	78	0.37
1.40	0.59	34	11.52	1.99	0.03	79	0.32
1.40	0.59	35	11.52	1.99	0.03	80	0.28
1.40	0.59	36	11.52	1.99	0.03	81	0.25
1.40	0.59	37	11.49	1.99	0.03	82	0.23
1.40	0.59	38	11.46	1.99	0.03	83	0.22
1.40	0.59	39	11.48	1.99	0.03	84	0.21
1.40	0.59	40	11.50	1.99	0.03	85	0.21
1.40	0.59	41	11.46	1.99	0.03	86	0.21
1.40	0.59	42	11.42	1.99	0.03	87	0.20
1.40	0.59	43	11.44	1.99	0.03	88	0.20
1.40	0.59	44	11.45	1.99	0.03	89	0.20
1.40	0.59	45	11.44	1.99	0.03	90	0.20

Material	LDPE	Temperature	80				
Length	150	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	45	11.94
1.99	0.03	1	0.11	1.40	0.59	47	11.96
1.99	0.03	2	0.11	1.40	0.59	48	11.98
1.99	0.03	3	0.11	1.40	0.59	49	11.93
1.99	0.03	4	0.11	1.40	0.59	50	11.89
1.99	0.03	5	0.11	1.40	0.59	51	11.92
1.99	0.03	6	0.11	1.40	0.59	52	11.96
1.99	0.03	7	0.11	1.40	0.59	53	11.94
1.99	0.03	8	0.11	1.40	0.59	54	11.92
1.99	0.03	9	0.11	1.39	0.59	55	11.94
1.40	0.59	10	1.55	1.39	0.59	56	11.96
1.40	0.59	11	3.00	1.40	0.59	57	11.93
1.40	0.59	12	6.51	1.39	0.59	58	11.98
1.40	0.59	13	10.03	1.40	0.59	59	11.91
1.40	0.59	14	11.48	1.40	0.59	60	11.97
1.40	0.59	15	12.93	1.40	0.59	61	11.95
1.40	0.59	16	12.81	1.39	0.59	62	11.98
1.40	0.59	17	12.70	1.39	0.59	63	11.96
1.40	0.59	18	12.64	1.40	0.59	64	11.98
1.40	0.59	19	12.59	1.40	0.59	65	12.04
1.40	0.59	20	12.49	1.40	0.59	66	11.98
1.40	0.59	21	12.39	1.40	0.59	67	12.04
1.40	0.59	22	12.36	1.40	0.59	68	11.98
1.40	0.59	23	12.33	1.40	0.59	69	11.99
1.40	0.59	24	12.27	1.39	0.59	70	12.00
1.40	0.59	25	12.21	1.99	0.03	71	10.87
1.40	0.59	26	12.19	1.99	0.03	72	9.74
1.40	0.59	27	12.17	1.99	0.03	73	6.73
1.40	0.59	28	12.15	1.99	0.03	74	3.71
1.40	0.59	29	12.12	1.99	0.03	75	2.17
1.40	0.59	30	12.08	1.99	0.03	76	0.63
1.40	0.59	31	12.04	1.99	0.03	77	0.50
1.40	0.59	32	12.05	1.99	0.03	78	0.38
1.40	0.59	33	12.05	1.99	0.03	79	0.33
1.40	0.59	34	12.00	1.99	0.03	80	0.28
1.40	0.59	35	11.96	1.99	0.03	81	0.26
1.40	0.59	36	11.97	1.99	0.03	82	0.23
1.40	0.59	37	11.99	1.99	0.03	83	0.22
1.40	0.59	38	11.96	1.99	0.03	84	0.21
1.40	0.59	39	11.93	1.99	0.03	85	0.21
1.40	0.59	40	11.94	1.99	0.03	86	0.21
1.40	0.59	41	11.95	1.99	0.03	87	0.21
1.40	0.59	42	11.96	1.99	0.03	88	0.21
1.40	0.59	43	11.96	1.99	0.03	89	0.21
1.40	0.59	44	11.95	1.99	0.03	90	0.21

Material	LDPE	Temperature	100				
Length	50	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	46	3.99
2.00	0.03	1	0.11	1.80	0.19	47	3.98
2.00	0.03	2	0.11	1.80	0.19	48	3.98
2.00	0.03	3	0.11	1.80	0.19	49	3.98
2.00	0.03	4	0.11	1.80	0.19	50	3.98
2.00	0.03	5	0.11	1.80	0.19	51	3.98
2.00	0.03	6	0.11	1.80	0.19	52	3.97
2.00	0.03	7	0.11	1.80	0.19	53	3.96
2.00	0.03	8	0.11	1.80	0.19	54	3.97
2.00	0.03	9	0.11	1.80	0.19	55	3.98
1.81	0.19	10	0.32	1.80	0.19	56	3.96
1.80	0.19	11	1.66	1.80	0.19	57	3.97
1.80	0.19	12	2.99	1.80	0.19	58	3.95
1.80	0.19	13	4.25	1.80	0.19	59	3.96
1.80	0.19	14	5.51	1.80	0.19	60	3.97
1.80	0.19	15	5.46	1.80	0.19	61	3.96
1.80	0.19	16	5.41	1.80	0.19	62	3.97
1.80	0.19	17	5.21	1.80	0.20	63	3.95
1.80	0.19	18	5.00	1.80	0.19	64	3.97
1.80	0.19	19	4.86	1.80	0.18	65	3.95
1.80	0.19	20	4.73	1.80	0.19	66	3.95
1.80	0.19	21	4.64	1.80	0.20	67	3.95
1.80	0.19	22	4.56	1.80	0.19	68	3.94
1.80	0.19	23	4.48	1.80	0.20	69	3.95
1.80	0.19	24	4.40	1.80	0.19	70	3.94
1.80	0.19	25	4.36	2.00	0.03	71	3.68
1.80	0.19	26	4.32	2.00	0.03	72	3.41
1.80	0.19	27	4.26	2.00	0.03	73	2.55
1.80	0.19	28	4.21	2.00	0.03	74	1.69
1.80	0.19	29	4.18	2.00	0.03	75	1.04
1.80	0.19	30	4.16	2.00	0.03	76	0.39
1.80	0.19	31	4.13	2.00	0.03	77	0.31
1.80	0.19	32	4.10	2.00	0.03	78	0.24
1.80	0.19	33	4.08	2.00	0.03	79	0.21
1.80	0.19	34	4.06	2.00	0.03	80	0.19
1.80	0.19	36	4.06	2.00	0.03	81	0.17
1.80	0.19	37	4.07	2.00	0.03	82	0.14
1.80	0.19	38	4.05	2.00	0.03	83	0.12
1.80	0.19	39	4.04	2.00	0.03	84	0.11
1.80	0.19	40	4.04	2.00	0.03	85	0.11
1.80	0.19	41	4.04	2.00	0.03	86	0.10
1.80	0.19	42	4.03	2.00	0.03	87	0.11
1.80	0.19	43	4.01	2.00	0.03	88	0.11
1.80	0.19	44	4.01	2.00	0.03	89	0.11
1.80	0.19	45	4.00	2.00	0.03	90	0.11

Material	LDPE	Temperature	100				
Length	50	Concentration	50				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.18	45	4.07
2.00	0.03	1	0.11	1.80	0.18	46	4.06
2.00	0.03	2	0.11	1.80	0.18	47	4.04
2.00	0.03	3	0.11	1.80	0.18	48	4.05
2.00	0.03	4	0.11	1.80	0.18	49	4.06
2.00	0.03	5	0.11	1.80	0.18	50	4.05
2.00	0.03	6	0.11	1.80	0.18	51	4.05
2.00	0.03	7	0.11	1.80	0.18	52	4.06
2.00	0.03	8	0.11	1.80	0.18	53	4.06
2.00	0.03	9	0.11	1.80	0.19	54	4.05
1.80	0.18	10	1.43	1.80	0.19	56	4.04
1.80	0.18	11	2.76	1.80	0.19	57	4.06
1.80	0.18	12	4.16	1.80	0.19	58	4.04
1.80	0.18	13	5.55	1.80	0.19	59	4.05
1.80	0.18	14	5.59	1.80	0.19	60	4.00
1.80	0.18	15	5.62	1.80	0.18	61	4.01
1.80	0.18	16	5.44	1.80	0.19	62	4.03
1.80	0.18	17	5.26	1.80	0.19	63	4.03
1.80	0.18	18	5.10	1.80	0.19	64	4.03
1.80	0.18	19	4.93	1.80	0.19	65	3.99
1.80	0.18	20	4.83	1.80	0.19	66	4.03
1.80	0.18	21	4.72	1.80	0.19	67	4.01
1.80	0.18	22	4.64	1.80	0.19	68	4.02
1.80	0.18	23	4.56	1.80	0.19	69	4.01
1.80	0.18	24	4.51	1.80	0.19	70	3.42
1.80	0.18	25	4.46	2.00	0.03	71	2.55
1.80	0.18	26	4.43	2.00	0.03	72	1.68
1.80	0.18	27	4.39	2.00	0.03	73	1.02
1.80	0.18	28	4.35	2.00	0.03	74	0.36
1.80	0.18	29	4.30	2.00	0.03	75	0.30
1.80	0.18	30	4.29	2.00	0.03	76	0.23
1.80	0.18	31	4.27	2.00	0.03	77	0.20
1.80	0.18	32	4.24	2.00	0.03	78	0.18
1.80	0.18	33	4.20	2.00	0.03	79	0.15
1.80	0.18	34	4.19	2.00	0.03	80	0.13
1.80	0.18	35	4.18	2.00	0.03	81	0.12
1.80	0.18	36	4.16	2.00	0.03	82	0.11
1.80	0.18	37	4.14	2.00	0.03	83	0.11
1.80	0.18	38	4.13	2.00	0.03	84	0.11
1.80	0.18	39	4.13	2.00	0.03	85	0.11
1.80	0.18	40	4.12	2.00	0.03	86	0.10
1.80	0.18	41	4.11	2.00	0.03	87	0.10
1.80	0.18	42	4.09	2.00	0.03	87	0.10
1.80	0.18	43	4.07	2.00	0.03	88	0.10
1.80	0.18	44	4.07	2.00	0.03	88	0.10

Material	LDPE	Temperature	100				
Length	50	Concentration	50				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	45	4.15
2.00	0.03	1	0.11	1.80	0.19	47	4.15
2.00	0.03	2	0.11	1.80	0.19	48	4.15
2.00	0.03	3	0.11	1.80	0.19	49	4.15
2.00	0.03	4	0.11	1.80	0.19	50	4.14
2.00	0.03	5	0.11	1.80	0.19	51	4.15
2.00	0.03	6	0.11	1.80	0.19	52	4.15
2.00	0.03	7	0.11	1.80	0.19	53	4.13
2.00	0.03	8	0.11	1.80	0.19	54	4.11
2.00	0.03	9	0.11	1.80	0.19	55	4.13
1.80	0.19	10	1.46	1.80	0.19	56	4.09
1.80	0.19	11	2.81	1.80	0.19	57	4.07
1.80	0.19	12	4.32	1.80	0.18	58	4.07
1.80	0.19	13	5.82	1.80	0.18	59	4.07
1.80	0.19	14	5.81	1.80	0.19	60	4.08
1.80	0.19	15	5.81	1.80	0.19	61	4.08
1.80	0.19	16	5.59	1.80	0.19	62	4.09
1.80	0.19	17	5.37	1.80	0.18	63	4.07
1.80	0.19	18	5.22	1.80	0.19	64	4.09
1.80	0.19	19	5.08	1.80	0.19	65	4.08
1.80	0.19	20	4.97	1.80	0.19	66	4.10
1.80	0.19	21	4.85	1.80	0.19	67	4.12
1.80	0.19	22	4.78	1.80	0.18	68	4.10
1.80	0.19	23	4.71	1.80	0.20	69	4.13
1.80	0.19	24	4.64	1.80	0.19	70	3.64
1.80	0.19	25	4.56	2.00	0.03	71	2.74
1.80	0.19	26	4.53	2.00	0.03	72	1.83
1.80	0.19	27	4.49	2.00	0.03	73	1.12
1.80	0.19	28	4.45	2.00	0.03	74	0.40
1.80	0.19	29	4.41	2.00	0.03	75	0.32
1.80	0.19	30	4.38	2.00	0.03	76	0.24
1.80	0.19	31	4.35	2.00	0.03	77	0.21
1.80	0.19	32	4.32	2.00	0.03	78	0.17
1.80	0.19	33	4.29	2.00	0.03	79	0.15
1.80	0.19	34	4.27	2.00	0.03	80	0.12
1.80	0.19	35	4.25	2.00	0.03	81	0.12
1.80	0.19	36	4.24	2.00	0.03	82	0.11
1.80	0.19	37	4.23	2.00	0.03	83	0.11
1.80	0.19	38	4.21	2.00	0.03	84	0.11
1.80	0.19	39	4.18	2.00	0.03	85	0.11
1.80	0.19	40	4.18	2.00	0.03	86	0.11
1.80	0.19	41	4.18	2.00	0.03	87	0.11
1.80	0.19	42	4.16	2.00	0.03	88	0.11
1.80	0.19	43	4.14	2.00	0.03	89	0.11
1.80	0.19	44	4.15	2.00	0.03	90	0.11

Material	LDPE	Temperature	100				
Length	50	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	11.88
1.99	0.03	1	0.11	1.40	0.59	47	11.86
1.99	0.03	2	0.11	1.40	0.59	48	11.88
1.99	0.03	3	0.11	1.40	0.59	49	11.89
1.99	0.03	4	0.11	1.40	0.59	50	11.90
1.99	0.03	5	0.11	1.40	0.59	51	11.90
1.99	0.03	6	0.11	1.40	0.59	52	11.89
1.99	0.03	7	0.10	1.40	0.59	53	11.88
1.99	0.03	8	0.10	1.40	0.59	54	11.91
1.99	0.03	9	0.10	1.40	0.59	55	11.93
1.39	0.59	10	4.73	1.40	0.59	56	11.89
1.40	0.59	11	7.90	1.40	0.59	57	11.96
1.40	0.59	12	11.08	1.40	0.59	58	11.91
1.40	0.59	13	11.87	1.40	0.59	59	11.94
1.40	0.59	14	12.65	1.40	0.59	60	11.95
1.40	0.59	15	12.58	1.40	0.58	61	11.94
1.40	0.59	16	12.50	1.40	0.59	62	11.97
1.40	0.59	17	12.41	1.40	0.59	63	11.91
1.40	0.59	18	12.31	1.40	0.59	64	11.99
1.40	0.59	19	12.27	1.40	0.59	65	11.97
1.40	0.59	20	12.22	1.40	0.59	66	12.00
1.40	0.59	21	12.19	1.40	0.59	67	11.98
1.40	0.59	22	12.16	1.40	0.59	68	11.97
1.40	0.59	23	12.11	1.40	0.59	69	12.03
1.40	0.59	24	12.07	1.40	0.59	70	11.97
1.40	0.59	25	12.07	1.99	0.03	71	10.95
1.40	0.59	26	12.08	1.99	0.03	72	9.93
1.40	0.59	27	12.03	1.99	0.03	73	7.12
1.40	0.59	28	11.98	1.99	0.03	74	4.30
1.40	0.59	29	11.98	1.99	0.03	75	2.43
1.40	0.59	30	11.99	1.99	0.03	76	0.55
1.40	0.59	31	11.96	1.99	0.03	77	0.45
1.40	0.59	32	11.93	1.99	0.03	78	0.34
1.40	0.59	33	11.94	1.99	0.03	79	0.29
1.40	0.59	34	11.94	1.99	0.03	80	0.25
1.40	0.59	35	11.94	1.99	0.03	81	0.23
1.40	0.59	36	11.94	1.99	0.03	82	0.21
1.40	0.59	37	11.91	1.99	0.03	83	0.21
1.40	0.59	38	11.89	1.99	0.03	84	0.21
1.40	0.59	39	11.91	1.99	0.03	85	0.19
1.40	0.59	40	11.93	1.99	0.03	86	0.17
1.40	0.59	41	11.89	1.99	0.03	87	0.14
1.40	0.59	42	11.86	1.99	0.03	88	0.11
1.40	0.59	43	11.88	1.99	0.03	89	0.11
1.40	0.59	45	11.90	1.99	0.03	90	0.11

Material	LDPE	Temperature	100				
Length	50	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	12.44
1.99	0.03	1	0.11	1.40	0.59	47	12.41
1.99	0.03	2	0.11	1.40	0.59	48	12.38
1.99	0.03	3	0.11	1.40	0.59	49	12.42
1.99	0.03	4	0.11	1.40	0.59	50	12.46
1.99	0.03	5	0.11	1.40	0.59	51	12.43
1.99	0.03	6	0.11	1.40	0.59	52	12.39
1.99	0.03	7	0.11	1.40	0.59	53	12.41
1.99	0.03	8	0.10	1.40	0.59	54	12.43
1.99	0.03	9	0.10	1.40	0.59	55	12.43
1.40	0.59	10	2.51	1.40	0.59	56	12.43
1.40	0.59	11	4.91	1.39	0.59	57	12.43
1.40	0.59	12	6.62	1.40	0.59	58	12.44
1.40	0.59	13	8.33	1.40	0.59	60	12.40
1.40	0.59	14	10.03	1.40	0.59	61	12.45
1.40	0.59	15	11.74	1.39	0.59	62	12.41
1.40	0.59	16	12.62	1.40	0.59	63	12.47
1.40	0.59	17	13.51	1.40	0.59	64	12.41
1.40	0.59	18	13.38	1.40	0.59	65	12.42
1.40	0.59	20	13.24	1.40	0.59	66	12.44
1.40	0.59	21	13.19	1.40	0.59	67	12.41
1.40	0.59	22	13.13	1.40	0.59	68	12.48
1.40	0.59	23	13.02	1.40	0.59	69	12.41
1.40	0.59	24	12.91	1.40	0.59	70	12.48
1.40	0.59	25	12.88	1.40	0.59	71	12.48
1.40	0.59	26	12.86	1.40	0.59	72	12.50
1.40	0.59	27	12.80	1.99	0.03	73	12.51
1.40	0.59	28	12.74	1.99	0.03	74	12.51
1.40	0.59	29	12.70	1.99	0.03	75	11.46
1.40	0.59	30	12.67	1.99	0.03	76	10.40
1.40	0.59	31	12.65	1.99	0.03	77	7.47
1.40	0.59	32	12.62	1.99	0.03	78	4.55
1.40	0.59	33	12.56	1.99	0.03	79	2.54
1.40	0.59	34	12.51	1.99	0.03	80	0.54
1.40	0.59	35	12.53	1.99	0.03	81	0.44
1.40	0.59	36	12.55	1.99	0.03	82	0.34
1.40	0.59	37	12.51	1.99	0.03	83	0.30
1.40	0.59	38	12.46	1.99	0.03	84	0.26
1.40	0.59	39	12.48	1.99	0.03	85	0.23
1.40	0.59	40	12.49	1.99	0.03	86	0.21
1.40	0.59	41	12.46	1.99	0.03	87	0.21
1.40	0.59	42	12.44	1.99	0.03	88	0.21
1.40	0.59	43	12.43	1.99	0.03	89	0.20
1.40	0.59	44	12.43	1.99	0.03	90	0.19
1.40	0.59	45	12.44	1.99	0.03	90	0.19

Material	LDPE	Temperature	100				
Length	50	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	12.88
1.99	0.03	1	0.11	1.40	0.59	47	12.86
1.99	0.03	2	0.11	1.40	0.59	48	12.85
1.99	0.03	3	0.11	1.40	0.59	49	12.85
1.99	0.03	4	0.11	1.40	0.59	50	12.85
1.99	0.03	5	0.11	1.40	0.59	51	12.86
1.99	0.03	6	0.11	1.40	0.59	52	12.88
1.99	0.03	7	0.11	1.40	0.59	53	12.85
1.99	0.03	8	0.10	1.40	0.59	54	12.82
1.99	0.03	9	0.10	1.39	0.59	55	12.90
1.40	0.59	10	3.08	1.39	0.59	56	12.84
1.40	0.59	11	6.05	1.40	0.59	57	12.90
1.40	0.59	12	7.78	1.40	0.59	58	12.88
1.40	0.59	13	9.51	1.40	0.59	59	12.89
1.40	0.59	14	11.24	1.39	0.59	60	12.93
1.40	0.59	15	12.96	1.40	0.59	61	12.89
1.40	0.59	16	13.46	1.39	0.59	62	12.95
1.40	0.59	17	13.96	1.40	0.59	63	12.88
1.40	0.59	18	13.83	1.40	0.59	64	12.93
1.40	0.59	19	13.70	1.39	0.59	65	12.89
1.40	0.59	20	13.58	1.40	0.59	66	12.91
1.40	0.59	21	13.47	1.40	0.60	67	12.94
1.40	0.59	22	13.43	1.40	0.59	68	12.89
1.40	0.59	23	13.39	1.40	0.59	69	12.95
1.40	0.59	24	13.30	1.40	0.59	70	12.88
1.40	0.59	25	13.22	1.99	0.03	71	12.91
1.40	0.59	26	13.20	1.99	0.03	72	12.95
1.40	0.59	27	13.18	1.99	0.03	73	11.99
1.40	0.59	28	13.12	1.99	0.03	74	11.03
1.40	0.59	30	13.05	1.99	0.03	75	7.95
1.40	0.59	31	13.05	1.99	0.03	76	4.87
1.40	0.59	32	13.05	1.99	0.03	77	2.71
1.40	0.59	33	13.02	1.99	0.03	78	0.56
1.40	0.59	34	12.99	1.99	0.03	79	0.45
1.40	0.59	35	12.96	1.99	0.03	80	0.34
1.40	0.59	36	12.92	1.99	0.03	81	0.30
1.40	0.59	37	12.94	1.99	0.03	82	0.25
1.40	0.59	38	12.95	1.99	0.03	83	0.23
1.40	0.59	39	12.91	1.99	0.03	84	0.21
1.40	0.59	40	12.88	1.99	0.03	85	0.21
1.40	0.59	41	12.90	1.99	0.03	86	0.21
1.40	0.59	42	12.92	1.99	0.03	87	0.20
1.40	0.59	43	12.88	1.99	0.03	89	0.19
1.40	0.59	44	12.83	1.99	0.03	90	0.19
1.40	0.59	45	12.85	1.99	0.03	91	0.19

Material	LDPE	Temperature	100				
Length	150	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.18	46	3.05
2.00	0.03	1	0.11	1.80	0.18	47	3.05
2.00	0.03	2	0.11	1.80	0.18	48	3.05
2.00	0.03	3	0.11	1.80	0.18	49	3.03
2.00	0.03	4	0.11	1.80	0.18	50	3.01
2.00	0.03	5	0.11	1.80	0.18	51	3.01
2.00	0.03	6	0.11	1.80	0.18	52	3.02
2.00	0.03	7	0.11	1.80	0.18	53	3.02
2.00	0.03	8	0.11	1.80	0.18	54	3.02
2.00	0.03	9	0.11	1.80	0.18	55	3.02
1.81	0.18	10	1.03	1.80	0.18	56	3.03
1.80	0.18	11	1.95	1.81	0.19	57	3.00
1.80	0.18	12	2.91	1.81	0.19	58	3.00
1.80	0.18	13	3.88	1.81	0.19	59	3.00
1.80	0.18	14	3.92	1.81	0.19	60	2.99
1.80	0.18	15	3.97	1.81	0.19	61	3.00
1.80	0.18	16	3.86	1.81	0.19	62	2.99
1.80	0.18	17	3.76	1.80	0.19	63	3.00
1.80	0.18	18	3.66	1.80	0.19	64	2.98
1.80	0.18	19	3.56	1.80	0.19	65	2.98
1.80	0.18	20	3.50	1.80	0.19	66	2.97
1.80	0.18	21	3.44	1.81	0.19	67	2.99
1.80	0.18	22	3.40	1.80	0.19	68	3.02
1.80	0.18	23	3.36	1.80	0.19	69	3.01
1.80	0.18	24	3.31	1.80	0.20	70	3.01
1.80	0.18	25	3.25	1.81	0.19	71	2.72
1.80	0.18	26	3.24	2.01	0.03	72	2.10
1.80	0.18	27	3.23	2.01	0.03	73	1.49
1.80	0.18	28	3.21	2.01	0.03	74	0.94
1.80	0.18	30	3.18	2.01	0.03	75	0.39
1.80	0.18	31	3.17	2.01	0.03	76	0.31
1.80	0.18	32	3.16	2.01	0.03	77	0.22
1.80	0.18	33	3.14	2.01	0.03	78	0.19
1.80	0.18	34	3.13	2.01	0.03	79	0.16
1.80	0.18	35	3.11	2.01	0.03	80	0.13
1.80	0.18	36	3.09	2.01	0.03	81	0.11
1.80	0.18	37	3.08	2.01	0.03	82	0.11
1.80	0.18	38	3.08	2.01	0.03	83	0.11
1.80	0.18	39	3.07	2.01	0.03	84	0.10
1.80	0.18	40	3.05	2.01	0.03	85	0.10
1.80	0.18	41	3.06	2.01	0.03	86	0.10
1.80	0.18	42	3.07	2.01	0.03	87	0.10
1.80	0.18	43	3.06	2.01	0.03	89	0.10
1.80	0.18	44	3.05	2.01	0.03	90	0.10
1.80	0.18	45	3.05	2.01	0.03	91	0.10

Material	LDPE	Temperature	100				
Length	150	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.10	1.80	0.19	46	3.20
2.00	0.03	1	0.10	1.80	0.19	47	3.19
2.00	0.03	2	0.10	1.80	0.19	48	3.17
2.00	0.03	3	0.10	1.80	0.19	49	3.16
2.00	0.03	4	0.10	1.80	0.19	50	3.17
2.00	0.03	5	0.10	1.80	0.19	51	3.17
2.00	0.03	6	0.10	1.80	0.19	52	3.17
2.00	0.03	7	0.10	1.80	0.19	53	3.17
2.00	0.03	8	0.10	1.80	0.19	54	3.17
2.00	0.03	9	0.10	1.80	0.19	55	3.17
1.80	0.19	10	1.94	1.80	0.19	56	3.17
1.80	0.19	11	3.02	1.80	0.19	57	3.15
1.80	0.19	12	4.09	1.81	0.19	58	3.17
1.80	0.19	13	4.18	1.80	0.18	59	3.15
1.80	0.19	14	4.27	1.80	0.19	60	3.16
1.80	0.19	15	4.12	1.80	0.19	61	3.17
1.80	0.19	16	3.97	1.81	0.19	62	3.15
1.80	0.19	17	3.87	1.80	0.19	63	3.17
1.80	0.19	18	3.78	1.80	0.18	64	3.16
1.80	0.19	19	3.70	1.80	0.19	65	3.17
1.80	0.19	20	3.62	1.80	0.19	66	3.14
1.80	0.19	21	3.56	1.80	0.19	67	3.16
1.80	0.19	22	3.50	1.80	0.19	68	3.16
1.80	0.19	23	3.47	1.80	0.19	69	3.14
1.80	0.19	24	3.43	1.80	0.19	70	2.87
1.80	0.19	25	3.41	2.00	0.03	71	2.22
1.80	0.19	26	3.38	2.00	0.03	72	1.56
1.80	0.19	27	3.37	2.00	0.03	73	0.98
1.80	0.19	28	3.37	2.00	0.03	74	0.40
1.80	0.19	30	3.34	2.00	0.03	75	0.32
1.80	0.19	31	3.31	2.00	0.03	76	0.23
1.80	0.19	32	3.30	2.00	0.03	77	0.20
1.80	0.19	33	3.28	2.00	0.03	78	0.17
1.80	0.19	34	3.27	2.00	0.03	79	0.14
1.80	0.19	35	3.26	2.00	0.03	80	0.12
1.80	0.19	36	3.25	2.00	0.03	81	0.11
1.80	0.19	37	3.25	2.00	0.03	82	0.11
1.80	0.19	38	3.25	2.00	0.03	83	0.11
1.80	0.19	39	3.25	2.00	0.03	84	0.10
1.80	0.19	40	3.24	2.00	0.03	85	0.11
1.80	0.19	41	3.24	2.00	0.03	86	0.11
1.80	0.19	42	3.24	2.00	0.03	87	0.10
1.80	0.19	43	3.25	2.00	0.03	89	0.10
1.80	0.19	44	3.23	2.00	0.03	90	0.10
1.80	0.19	45	3.21	2.00	0.03	91	0.10

Material	LDPE	Temperature	100				
Length	150	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.11	1.80	0.19	46	3.27
2.00	0.03	1	0.11	1.80	0.19	47	3.27
2.00	0.03	2	0.11	1.80	0.19	48	3.28
2.00	0.03	3	0.11	1.80	0.19	49	3.26
2.00	0.03	4	0.11	1.80	0.19	50	3.25
2.00	0.03	5	0.11	1.80	0.19	51	3.25
2.00	0.03	6	0.11	1.80	0.19	52	3.26
2.00	0.03	7	0.11	1.80	0.19	53	3.25
2.00	0.03	8	0.11	1.80	0.19	54	3.23
2.00	0.03	9	0.11	1.80	0.19	55	3.24
1.80	0.19	10	2.06	1.80	0.19	56	3.24
1.80	0.19	11	4.29	1.80	0.19	57	3.26
1.80	0.19	12	4.37	1.80	0.19	58	3.24
1.80	0.19	13	4.45	1.80	0.19	59	3.25
1.80	0.19	14	4.31	1.80	0.19	60	3.24
1.80	0.19	15	4.16	1.80	0.19	61	3.27
1.80	0.19	16	4.03	1.80	0.18	62	3.26
1.80	0.19	17	3.91	1.80	0.20	63	3.27
1.80	0.19	18	3.84	1.81	0.19	64	3.27
1.80	0.19	19	3.77	1.80	0.18	65	3.25
1.80	0.19	20	3.70	1.80	0.19	66	3.26
1.80	0.19	21	3.64	1.80	0.18	67	3.24
1.80	0.19	22	3.61	1.80	0.19	68	3.26
1.80	0.19	23	3.58	1.80	0.19	69	3.25
1.80	0.19	24	3.54	1.80	0.18	70	3.05
1.80	0.19	25	3.50	2.00	0.03	71	2.39
1.80	0.19	26	3.48	2.00	0.03	72	1.73
1.80	0.19	27	3.46	2.00	0.03	73	1.07
1.80	0.19	28	3.44	2.00	0.03	74	0.41
1.80	0.19	30	3.42	2.00	0.03	75	0.32
1.80	0.19	31	3.40	2.00	0.03	76	0.23
1.80	0.19	32	3.37	2.00	0.03	77	0.20
1.80	0.19	33	3.36	2.00	0.03	78	0.17
1.80	0.19	34	3.36	2.00	0.03	79	0.15
1.80	0.19	35	3.34	2.00	0.03	80	0.12
1.80	0.19	36	3.32	2.00	0.03	81	0.12
1.80	0.19	37	3.32	2.00	0.03	82	0.11
1.80	0.19	38	3.31	2.00	0.03	83	0.11
1.80	0.19	39	3.30	2.00	0.03	84	0.11
1.80	0.19	40	3.29	2.00	0.03	85	0.11
1.80	0.19	41	3.29	2.00	0.03	86	0.11
1.80	0.19	42	3.29	2.00	0.03	87	0.11
1.80	0.19	43	3.29	2.00	0.03	89	0.11
1.80	0.19	44	3.29	2.00	0.03	90	0.11
1.80	0.19	45	3.28	2.00	0.03	91	0.11

Material	LDPE	Temperature	100				
Length	150	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	10.74
1.99	0.03	1	0.11	1.40	0.59	47	10.77
1.99	0.03	2	0.11	1.40	0.59	48	10.80
1.99	0.03	3	0.11	1.40	0.59	49	10.78
1.99	0.03	4	0.11	1.40	0.59	50	10.75
1.99	0.03	5	0.11	1.40	0.59	51	10.76
1.99	0.03	6	0.11	1.40	0.59	52	10.77
1.99	0.03	7	0.11	1.40	0.59	53	10.77
1.99	0.03	8	0.11	1.40	0.59	54	10.77
1.99	0.03	9	0.11	1.40	0.59	55	10.76
1.40	0.59	10	1.96	1.40	0.60	56	10.79
1.40	0.59	11	3.81	1.40	0.59	57	10.74
1.40	0.59	12	5.27	1.39	0.60	58	10.78
1.40	0.59	13	6.74	1.40	0.60	59	10.72
1.40	0.59	14	8.20	1.40	0.59	60	10.75
1.40	0.59	15	9.67	1.40	0.59	61	10.75
1.40	0.59	16	10.70	1.40	0.59	62	10.73
1.40	0.59	17	11.73	1.40	0.59	63	10.77
1.40	0.59	18	11.66	1.39	0.59	64	10.72
1.40	0.59	19	11.60	1.39	0.60	65	10.79
1.40	0.59	20	11.49	1.40	0.59	66	10.75
1.40	0.59	21	11.38	1.39	0.59	67	10.77
1.40	0.59	22	11.32	1.40	0.60	68	10.78
1.40	0.59	23	11.26	1.40	0.59	69	10.76
1.40	0.59	24	11.21	1.40	0.59	70	10.81
1.40	0.59	25	11.15	2.00	0.03	71	10.77
1.40	0.59	26	11.09	2.00	0.03	72	10.74
1.40	0.59	27	11.04	2.00	0.03	73	10.04
1.40	0.59	28	11.04	2.00	0.03	74	9.33
1.40	0.59	29	11.03	2.00	0.03	75	6.85
1.40	0.59	30	10.98	2.00	0.03	76	4.37
1.40	0.59	31	10.93	2.00	0.03	77	2.49
1.40	0.59	32	10.93	2.00	0.03	78	0.61
1.40	0.59	33	10.94	2.00	0.03	79	0.48
1.40	0.59	34	10.90	2.00	0.03	80	0.35
1.40	0.59	35	10.86	2.00	0.03	81	0.31
1.40	0.59	37	10.86	2.00	0.03	82	0.26
1.40	0.59	38	10.86	2.00	0.03	83	0.24
1.40	0.59	39	10.84	2.00	0.03	84	0.21
1.40	0.59	40	10.83	2.00	0.03	85	0.21
1.40	0.59	41	10.80	2.00	0.03	86	0.21
1.40	0.59	42	10.77	2.00	0.03	87	0.21
1.40	0.59	43	10.79	2.00	0.03	88	0.21
1.40	0.59	44	10.81	2.00	0.03	89	0.21
1.40	0.59	45	10.77	2.00	0.03	90	0.21

Material	LDPE	Temperature	100				
Length	150	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	45	11.06
1.99	0.03	1	0.11	1.40	0.59	46	11.09
1.99	0.03	2	0.11	1.40	0.59	47	11.12
1.99	0.03	3	0.11	1.40	0.59	48	11.09
1.99	0.03	4	0.11	1.40	0.59	49	11.06
1.99	0.03	5	0.11	1.40	0.59	50	11.06
1.99	0.03	6	0.11	1.40	0.59	51	11.07
1.99	0.03	7	0.11	1.40	0.59	53	11.08
1.99	0.03	8	0.11	1.40	0.59	54	11.08
1.99	0.03	9	0.11	1.40	0.59	55	11.07
1.40	0.59	10	2.42	1.40	0.59	56	11.11
1.40	0.59	11	4.74	1.40	0.59	57	11.05
1.40	0.59	12	7.74	1.39	0.59	58	11.10
1.40	0.59	13	10.75	1.40	0.59	59	11.07
1.40	0.59	14	11.37	1.40	0.59	60	11.11
1.40	0.59	15	11.98	1.39	0.58	61	11.09
1.40	0.59	16	11.86	1.40	0.59	62	11.07
1.40	0.59	17	11.73	1.39	0.59	63	11.13
1.40	0.59	18	11.69	1.39	0.59	64	11.07
1.40	0.59	19	11.66	1.40	0.59	65	11.13
1.40	0.59	20	11.58	1.40	0.59	66	11.08
1.40	0.59	21	11.50	1.39	0.59	67	11.12
1.40	0.59	22	11.46	1.39	0.59	68	11.15
1.40	0.59	23	11.41	1.40	0.59	69	11.11
1.40	0.59	24	11.38	1.40	0.59	70	11.16
1.40	0.59	25	11.35	1.99	0.03	71	10.53
1.40	0.59	26	11.30	1.99	0.03	72	9.91
1.40	0.59	27	11.26	1.99	0.03	73	7.34
1.40	0.59	28	11.26	1.99	0.03	74	4.76
1.40	0.59	29	11.27	1.99	0.03	75	2.68
1.40	0.59	30	11.23	1.99	0.03	76	0.60
1.40	0.59	31	11.18	1.99	0.03	77	0.48
1.40	0.59	32	11.19	1.99	0.03	78	0.36
1.40	0.59	33	11.20	1.99	0.03	79	0.31
1.40	0.59	34	11.16	1.99	0.03	80	0.27
1.40	0.59	35	11.13	1.99	0.03	81	0.24
1.40	0.59	36	11.14	1.99	0.03	82	0.22
1.40	0.59	37	11.16	1.99	0.03	83	0.21
1.40	0.59	38	11.15	1.99	0.03	84	0.21
1.40	0.59	39	11.14	1.99	0.03	85	0.20
1.40	0.59	40	11.10	1.99	0.03	86	0.20
1.40	0.59	41	11.07	1.99	0.03	87	0.17
1.40	0.59	42	11.08	1.99	0.03	88	0.15
1.40	0.59	43	11.10	1.99	0.03	88	0.15
1.40	0.59	44	11.08	1.99	0.03	89	0.15

Material	LDPE	Temperature	100				
Length	150	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	11.44
1.99	0.03	1	0.11	1.40	0.59	47	11.42
1.99	0.03	2	0.11	1.40	0.59	48	11.41
1.99	0.03	3	0.11	1.40	0.59	49	11.44
1.99	0.03	4	0.11	1.40	0.59	50	11.47
1.99	0.03	5	0.11	1.40	0.59	51	11.45
1.99	0.03	6	0.11	1.40	0.59	52	11.44
1.99	0.03	7	0.11	1.40	0.59	53	11.45
1.99	0.03	8	0.11	1.40	0.59	54	11.47
1.99	0.03	9	0.11	1.39	0.59	55	11.43
1.40	0.59	10	2.46	1.40	0.59	56	11.43
1.40	0.59	11	4.80	1.40	0.59	57	11.46
1.40	0.59	12	7.83	1.40	0.59	58	11.43
1.40	0.59	13	10.87	1.40	0.59	59	11.50
1.40	0.59	14	11.58	1.40	0.59	60	11.44
1.40	0.59	15	12.30	1.40	0.59	61	11.48
1.40	0.59	16	12.23	1.40	0.59	62	11.47
1.40	0.59	17	12.17	1.39	0.59	63	11.47
1.40	0.59	18	12.06	1.40	0.59	64	11.51
1.40	0.59	19	11.96	1.40	0.60	65	11.46
1.40	0.59	20	11.92	1.40	0.59	66	11.53
1.40	0.59	21	11.87	1.40	0.59	67	11.49
1.40	0.59	22	11.80	1.40	0.59	68	11.52
1.40	0.59	23	11.73	1.40	0.59	69	11.49
1.40	0.59	24	11.72	1.40	0.59	70	11.49
1.40	0.59	25	11.71	1.99	0.03	71	10.86
1.40	0.59	26	11.66	1.99	0.03	72	10.23
1.40	0.59	27	11.62	1.99	0.03	73	7.52
1.40	0.59	28	11.60	1.99	0.03	74	4.82
1.40	0.59	29	11.58	1.99	0.03	75	2.71
1.40	0.59	30	11.57	1.99	0.03	76	0.61
1.40	0.59	32	11.55	1.99	0.03	77	0.49
1.40	0.59	33	11.51	1.99	0.03	78	0.36
1.40	0.59	34	11.48	1.99	0.03	79	0.32
1.40	0.59	35	11.50	1.99	0.03	80	0.28
1.40	0.59	36	11.53	1.99	0.03	81	0.25
1.40	0.59	37	11.50	1.99	0.03	82	0.23
1.40	0.59	38	11.46	1.99	0.03	83	0.22
1.40	0.59	39	11.48	1.99	0.03	84	0.21
1.40	0.59	40	11.50	1.99	0.03	85	0.21
1.40	0.59	41	11.48	1.99	0.03	86	0.21
1.40	0.59	42	11.46	1.99	0.03	87	0.21
1.40	0.59	43	11.45	1.99	0.03	88	0.21
1.40	0.59	44	11.44	1.99	0.03	89	0.21
1.40	0.59	45	11.44	1.99	0.03	90	0.21

Material	Teflon	Temperature	80				
Length	150	Concentration	10				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.12	1.58	0.34	46	8.71
1.97	0.00	1	0.12	1.58	0.34	47	8.71
1.97	0.00	2	0.12	1.58	0.35	48	8.69
1.97	0.00	3	0.12	1.58	0.35	49	8.69
1.97	0.00	4	0.12	1.58	0.34	50	8.70
1.97	0.00	5	0.12	1.58	0.33	51	8.71
1.97	0.00	6	0.12	1.58	0.35	52	8.72
1.97	0.00	7	0.17	1.58	0.34	53	8.72
1.97	0.00	8	0.17	1.58	0.36	54	8.72
1.97	0.00	9	0.17	1.58	0.33	55	8.72
1.58	0.34	10	1.11	1.59	0.34	56	8.75
1.58	0.34	11	2.05	1.58	0.34	57	8.76
1.58	0.34	12	4.12	1.58	0.36	58	8.76
1.58	0.34	13	6.19	1.58	0.35	59	8.76
1.58	0.34	14	7.83	1.58	0.34	61	8.77
1.58	0.34	15	9.47	1.58	0.34	62	8.77
1.58	0.34	16	9.45	1.58	0.33	63	8.78
1.58	0.34	17	9.43	1.58	0.34	64	8.79
1.58	0.34	18	9.35	1.58	0.34	65	8.79
1.58	0.34	19	9.27	1.58	0.34	66	8.80
1.58	0.34	21	9.20	1.58	0.34	67	8.81
1.58	0.34	22	9.12	1.58	0.34	68	8.82
1.58	0.34	23	9.07	1.58	0.35	69	8.84
1.58	0.34	24	9.02	1.58	0.34	70	8.84
1.58	0.34	25	8.98	1.59	0.34	71	8.57
1.58	0.34	26	8.94	1.97	0.01	72	7.07
1.58	0.34	27	8.90	1.97	0.01	73	5.57
1.58	0.34	28	8.87	1.97	0.01	74	3.41
1.58	0.34	29	8.85	1.97	0.01	75	1.24
1.58	0.34	30	8.82	1.97	0.01	76	0.93
1.58	0.34	31	8.81	1.97	0.01	77	0.62
1.58	0.34	32	8.79	1.97	0.01	78	0.53
1.58	0.34	33	8.78	1.97	0.01	79	0.45
1.58	0.34	34	8.78	1.97	0.00	80	0.40
1.58	0.34	35	8.77	1.97	0.00	81	0.35
1.58	0.34	36	8.77	1.97	0.00	82	0.32
1.58	0.34	37	8.76	1.97	0.00	83	0.29
1.58	0.34	38	8.75	1.97	0.00	84	0.26
1.58	0.34	39	8.73	1.97	0.00	85	0.24
1.58	0.34	40	8.71	1.97	0.00	86	0.23
1.58	0.34	41	8.70	1.97	0.00	87	0.22
1.58	0.34	42	8.69	1.97	0.00	88	0.20
1.58	0.35	43	8.69	1.97	0.00	89	0.17
1.58	0.34	44	8.71	1.97	0.00	90	0.14
1.58	0.34	45	8.71	1.97	0.00	91	0.14

Material	Teflon	Temperature	100				
Length	150	Concentration	10				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.06	1.58	0.34	45	8.87
1.97	0.00	1	0.06	1.58	0.35	46	8.87
1.97	0.00	2	0.06	1.58	0.34	47	8.87
1.97	0.00	3	0.06	1.58	0.33	48	8.89
1.97	0.00	4	0.06	1.58	0.34	49	8.89
1.97	0.00	5	0.06	1.58	0.34	50	8.89
1.97	0.00	6	0.06	1.58	0.34	51	8.88
1.97	0.00	7	0.11	1.58	0.34	52	8.88
1.97	0.00	8	0.11	1.58	0.34	53	8.88
1.97	0.00	9	0.11	1.58	0.34	54	8.91
1.58	0.34	10	1.29	1.58	0.34	55	8.89
1.58	0.34	11	2.47	1.58	0.34	56	8.91
1.58	0.34	12	4.71	1.58	0.34	57	8.91
1.58	0.34	13	6.94	1.58	0.34	58	8.93
1.58	0.34	14	8.02	1.58	0.34	59	8.94
1.58	0.34	15	9.09	1.58	0.34	60	8.94
1.58	0.34	16	9.44	1.58	0.34	61	8.95
1.58	0.34	17	9.79	1.58	0.36	62	8.98
1.58	0.34	18	9.69	1.58	0.34	63	8.97
1.58	0.34	19	9.59	1.58	0.34	64	8.95
1.58	0.34	20	9.51	1.58	0.34	65	8.95
1.58	0.34	21	9.43	1.58	0.33	66	8.95
1.58	0.34	22	9.38	1.58	0.34	67	8.96
1.58	0.34	23	9.32	1.58	0.34	68	8.97
1.58	0.34	24	9.27	1.58	0.33	69	7.89
1.58	0.34	25	9.22	1.97	0.01	70	6.34
1.58	0.34	26	9.19	1.97	0.01	71	4.80
1.58	0.34	27	9.15	1.97	0.01	72	3.11
1.58	0.34	28	9.12	1.97	0.01	73	1.42
1.58	0.34	29	9.09	1.97	0.01	74	1.04
1.58	0.34	30	9.06	1.97	0.01	75	0.65
1.58	0.34	31	9.04	1.97	0.00	76	0.57
1.58	0.34	32	9.03	1.97	0.00	77	0.48
1.58	0.34	33	9.02	1.97	0.00	78	0.42
1.58	0.34	34	9.00	1.97	0.00	79	0.37
1.58	0.34	35	8.98	1.97	0.00	80	0.33
1.58	0.34	36	8.97	1.97	0.00	81	0.28
1.58	0.34	37	8.96	1.97	0.00	82	0.26
1.58	0.34	38	8.96	1.97	0.00	83	0.24
1.58	0.34	39	8.95	1.97	0.00	84	0.23
1.58	0.34	40	8.93	1.97	0.00	85	0.22
1.58	0.34	41	8.90	1.97	0.00	86	0.20
1.58	0.35	42	8.89	1.97	0.00	87	0.18
1.58	0.34	43	8.89	1.97	0.00	88	0.17
1.58	0.35	44	8.89	1.97	0.00	89	0.15

Material	Teflon	Temperature	100				
Length	150	Concentration	10				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.12	1.58	0.34	44	8.89
1.97	0.00	1	0.12	1.58	0.34	45	8.89
1.97	0.00	2	0.12	1.58	0.34	46	8.88
1.97	0.00	3	0.12	1.58	0.34	47	8.86
1.97	0.00	4	0.12	1.58	0.35	48	8.87
1.97	0.00	5	0.12	1.58	0.34	49	8.87
1.97	0.00	6	0.12	1.58	0.34	50	8.87
1.97	0.00	7	0.20	1.58	0.36	51	8.86
1.97	0.00	8	0.20	1.58	0.34	52	8.85
1.97	0.00	9	0.20	1.58	0.35	53	8.85
1.58	0.34	10	1.35	1.58	0.34	54	8.85
1.58	0.34	11	2.49	1.58	0.34	55	8.86
1.58	0.34	12	4.89	1.58	0.36	56	8.88
1.58	0.34	13	7.29	1.58	0.34	57	8.87
1.58	0.34	14	8.47	1.58	0.34	58	8.88
1.58	0.34	15	9.66	1.58	0.34	59	8.86
1.58	0.34	16	9.61	1.58	0.36	60	8.86
1.58	0.34	17	9.57	1.58	0.34	61	8.86
1.58	0.34	18	9.50	1.58	0.34	62	8.86
1.58	0.34	19	9.44	1.58	0.34	63	8.86
1.58	0.34	20	9.38	1.58	0.34	64	8.88
1.58	0.34	21	9.32	1.58	0.33	65	8.88
1.58	0.34	22	9.29	1.58	0.34	66	8.88
1.58	0.34	23	9.25	1.58	0.34	67	8.87
1.58	0.34	24	9.24	1.58	0.34	68	8.46
1.58	0.34	25	9.23	1.97	0.00	69	6.66
1.58	0.34	26	9.20	1.97	0.00	70	4.87
1.58	0.34	27	9.17	1.97	0.00	71	3.13
1.58	0.34	28	9.14	1.97	0.00	72	1.39
1.58	0.34	29	9.10	1.97	0.00	73	1.03
1.58	0.34	30	9.08	1.97	0.00	74	0.67
1.58	0.34	31	9.06	1.97	0.00	75	0.58
1.58	0.34	32	9.04	1.97	0.00	76	0.49
1.58	0.34	33	9.03	1.97	0.00	77	0.43
1.58	0.34	34	9.01	1.97	0.00	78	0.38
1.58	0.34	35	8.99	1.97	0.00	79	0.34
1.58	0.34	36	8.97	1.97	0.00	80	0.30
1.58	0.34	37	8.95	1.97	0.00	81	0.28
1.58	0.34	38	8.94	1.97	0.00	82	0.25
1.58	0.34	38	8.93	1.97	0.00	83	0.25
1.58	0.34	39	8.89	1.97	0.00	84	0.24
1.58	0.34	40	8.89	1.97	0.00	85	0.22
1.58	0.36	41	8.88	1.97	0.00	86	0.21
1.58	0.34	42	8.89	1.97	0.00	87	0.16
1.58	0.34	43	8.89	1.97	0.00	88	0.14

Material	Teflon	Temperature	80				
Length	50	Concentration	10				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.10	1.58	0.34	45	9.10
1.97	0.00	1	0.10	1.58	0.34	46	9.11
1.97	0.00	2	0.10	1.58	0.34	47	9.12
1.97	0.00	3	0.13	1.59	0.34	48	9.12
1.97	0.00	4	0.13	1.59	0.35	49	9.12
1.97	0.00	5	0.13	1.59	0.34	50	9.15
1.97	0.00	6	0.13	1.59	0.34	51	9.15
1.97	0.00	7	0.05	1.59	0.34	52	9.16
1.97	0.00	8	0.28	1.58	0.34	53	9.18
1.97	0.00	9	0.28	1.58	0.34	54	9.22
1.59	0.34	10	2.06	1.58	0.34	56	9.22
1.59	0.34	11	3.84	1.58	0.34	57	9.24
1.59	0.34	12	6.76	1.58	0.33	58	9.24
1.59	0.34	13	9.68	1.58	0.34	59	9.26
1.59	0.34	14	9.57	1.58	0.35	60	9.27
1.59	0.34	15	9.46	1.58	0.34	61	9.28
1.59	0.34	16	9.43	1.58	0.34	62	9.27
1.59	0.34	17	9.41	1.58	0.34	63	9.29
1.59	0.34	18	9.35	1.59	0.34	64	9.32
1.59	0.34	19	9.28	1.58	0.34	65	9.35
1.59	0.34	20	9.24	1.58	0.35	66	9.37
1.59	0.34	21	9.20	1.58	0.34	67	9.37
1.59	0.34	22	9.19	1.58	0.33	68	9.37
1.59	0.34	23	9.17	1.58	0.34	69	9.39
1.59	0.34	24	9.17	1.58	0.34	70	8.76
1.59	0.34	25	9.16	1.97	0.00	71	3.05
1.59	0.34	26	9.14	1.97	0.00	72	1.27
1.59	0.34	27	9.11	1.97	0.00	73	0.63
1.59	0.34	28	9.09	1.97	0.00	74	0.61
1.59	0.34	29	9.07	1.97	0.00	75	0.29
1.59	0.34	30	9.07	1.97	0.00	76	0.27
1.59	0.34	31	9.07	1.97	0.00	77	0.15
1.59	0.34	32	9.07	1.97	0.00	78	0.18
1.59	0.34	33	9.07	1.97	0.00	79	0.11
1.59	0.34	34	9.07	1.97	0.00	80	0.14
1.59	0.34	35	9.07	1.97	0.00	81	0.08
1.59	0.34	36	9.07	1.97	0.00	82	0.10
1.59	0.34	37	9.07	1.97	0.00	83	0.05
1.59	0.34	38	9.07	1.97	0.00	84	0.06
1.59	0.34	39	9.07	1.97	0.00	85	0.04
1.60	0.34	40	9.07	1.97	0.00	86	0.05
1.58	0.34	41	9.08	1.97	0.00	87	0.04
1.58	0.34	42	9.09	1.97	0.00	88	0.06
1.58	0.34	43	9.09	1.97	0.00	89	0.04
1.58	0.34	44	9.10	1.97	0.00	90	0.05

Material	Teflon	Temperature	80				
Length	50	Concentration	10				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	1.59	0.33	45	8.89
1.97	0.00	1	0.05	1.58	0.34	46	8.91
1.97	0.00	2	0.05	1.58	0.34	47	8.92
1.97	0.00	3	0.05	1.58	0.34	48	8.92
1.97	0.00	4	0.05	1.58	0.34	49	8.93
1.97	0.00	5	0.05	1.58	0.34	50	8.94
1.97	0.00	6	0.05	1.58	0.35	51	8.92
1.97	0.00	7	0.08	1.58	0.33	52	8.94
1.97	0.00	8	0.08	1.58	0.34	53	8.93
1.97	0.00	9	0.08	1.58	0.34	54	8.93
1.58	0.33	10	3.38	1.58	0.34	56	8.92
1.58	0.33	11	6.68	1.58	0.33	57	8.92
1.58	0.33	12	7.41	1.58	0.34	58	8.97
1.58	0.33	13	8.14	1.58	0.34	59	8.99
1.58	0.33	14	8.94	1.58	0.35	60	9.00
1.58	0.33	15	9.73	1.59	0.34	61	9.03
1.58	0.33	16	9.64	1.58	0.34	62	9.02
1.58	0.33	17	9.55	1.58	0.36	63	9.00
1.58	0.33	18	9.47	1.58	0.34	64	9.00
1.58	0.33	19	9.40	1.58	0.36	65	9.02
1.58	0.33	20	9.34	1.58	0.34	66	9.03
1.58	0.33	21	9.29	1.58	0.34	67	9.03
1.58	0.33	22	9.24	1.58	0.34	68	9.02
1.58	0.33	23	9.19	1.58	0.34	69	8.42
1.58	0.33	24	9.15	1.58	0.34	70	3.52
1.58	0.33	25	9.11	1.97	0.00	71	2.08
1.58	0.33	26	9.08	1.97	0.00	72	0.64
1.58	0.33	27	9.04	1.97	0.00	73	0.47
1.58	0.33	28	9.03	1.97	0.00	74	0.30
1.58	0.33	29	9.02	1.97	0.00	75	0.24
1.58	0.33	30	9.00	1.97	0.00	76	0.19
1.58	0.33	31	8.99	1.97	0.00	77	0.17
1.58	0.33	32	8.97	1.97	0.00	78	0.15
1.58	0.33	33	8.96	1.97	0.00	79	0.14
1.58	0.33	34	8.95	1.97	0.00	80	0.13
1.58	0.33	35	8.94	1.97	0.00	81	0.11
1.58	0.33	36	8.94	1.97	0.00	82	0.08
1.58	0.33	37	8.94	1.97	0.00	83	0.07
1.58	0.33	38	8.92	1.97	0.00	84	0.05
1.58	0.33	39	8.91	1.97	0.00	85	0.05
1.58	0.34	40	8.90	1.97	0.00	86	0.05
1.59	0.33	41	8.90	1.97	0.00	87	0.05
1.58	0.33	42	8.89	1.97	0.00	88	0.05
1.58	0.35	43	8.88	1.97	0.00	89	0.05
1.59	0.34	44	8.89	1.97	0.00	90	0.05

Material	Teflon	Temperature	80				
Length	50	Concentration	10				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	1.58	0.35	46	8.98
1.97	0.00	1	0.05	1.58	0.34	47	8.96
1.97	0.00	2	0.05	1.58	0.34	48	8.94
1.97	0.00	3	0.05	1.58	0.35	49	8.95
1.97	0.00	4	0.05	1.58	0.34	50	8.95
1.97	0.00	5	0.05	1.58	0.34	51	8.95
1.97	0.00	6	0.05	1.58	0.34	52	8.96
1.97	0.00	7	0.05	1.58	0.34	53	8.96
1.97	0.00	8	0.05	1.58	0.35	54	8.96
1.97	0.00	9	0.10	1.58	0.34	55	8.97
1.58	0.34	10	1.40	1.58	0.34	56	8.97
1.58	0.34	11	2.70	1.58	0.34	57	8.96
1.58	0.34	12	4.95	1.58	0.35	58	8.97
1.58	0.34	13	7.20	1.58	0.34	59	8.97
1.58	0.34	14	8.06	1.58	0.34	60	8.99
1.58	0.34	15	8.91	1.58	0.36	61	8.99
1.58	0.34	16	9.45	1.58	0.34	62	9.00
1.58	0.34	17	9.99	1.58	0.33	63	8.99
1.58	0.34	18	9.87	1.58	0.34	64	9.01
1.58	0.34	19	9.76	1.58	0.34	65	9.00
1.58	0.34	20	9.68	1.58	0.34	66	9.01
1.58	0.34	21	9.61	1.58	0.34	67	9.01
1.58	0.34	22	9.53	1.58	0.35	68	9.02
1.58	0.34	23	9.46	1.58	0.33	69	9.02
1.58	0.34	24	9.41	1.58	0.34	70	8.62
1.58	0.34	25	9.36	1.97	0.00	71	6.30
1.58	0.34	26	9.33	1.97	0.00	72	3.97
1.58	0.34	27	9.30	1.97	0.00	73	2.34
1.58	0.34	28	9.25	1.97	0.00	74	0.71
1.58	0.34	29	9.21	1.97	0.00	75	0.51
1.58	0.34	30	9.18	1.97	0.00	76	0.31
1.58	0.34	31	9.14	1.97	0.00	77	0.25
1.58	0.34	32	9.13	1.97	0.00	78	0.20
1.58	0.34	33	9.11	1.97	0.00	79	0.18
1.58	0.34	34	9.09	1.97	0.00	80	0.16
1.58	0.34	35	9.07	1.97	0.00	81	0.15
1.58	0.34	37	9.06	1.97	0.00	82	0.14
1.58	0.34	38	9.06	1.97	0.00	83	0.11
1.58	0.34	39	9.05	1.97	0.00	84	0.09
1.58	0.34	40	9.05	1.97	0.00	85	0.07
1.58	0.34	41	9.03	1.97	0.00	86	0.06
1.58	0.33	42	9.01	1.97	0.00	87	0.05
1.58	0.35	43	9.00	1.97	0.00	88	0.05
1.58	0.34	44	8.99	1.97	0.00	89	0.05
1.58	0.33	45	9.00	1.97	0.00	90	0.06

Material	Teflon	Temperature	100				
Length	50	Concentration	2				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.02	1.92	0.10	46	1.11
2.00	0.00	1	0.02	1.92	0.10	47	1.04
2.00	0.00	2	0.02	1.92	0.10	48	0.98
2.00	0.00	3	0.04	1.92	0.10	49	0.95
2.00	0.00	4	0.04	1.92	0.10	50	0.92
2.00	0.00	5	0.04	1.92	0.10	51	0.96
2.00	0.00	6	0.04	1.92	0.10	52	1.01
2.00	0.00	7	0.04	1.92	0.10	53	1.04
2.00	0.00	8	0.04	1.92	0.10	54	1.07
2.00	0.00	9	0.04	1.92	0.10	55	0.99
1.92	0.10	10	0.12	1.92	0.10	56	0.91
1.92	0.10	11	0.20	1.92	0.10	57	0.81
1.92	0.10	12	0.29	1.92	0.10	58	0.71
1.92	0.10	13	0.37	1.92	0.10	59	0.81
1.92	0.10	14	0.80	1.92	0.10	60	0.90
1.92	0.10	15	1.22	1.92	0.10	61	1.00
1.92	0.10	16	1.44	1.92	0.10	62	1.10
1.92	0.10	17	1.65	1.92	0.10	63	1.08
1.92	0.10	18	1.61	1.92	0.10	64	1.07
1.92	0.10	19	1.57	1.92	0.10	65	1.06
1.92	0.10	20	1.52	1.92	0.10	66	1.05
1.92	0.10	21	1.47	1.92	0.10	67	1.06
1.92	0.10	22	1.42	1.92	0.10	68	1.08
1.92	0.10	23	1.37	1.92	0.10	69	1.06
1.92	0.10	24	1.35	1.91	0.10	70	1.03
1.92	0.10	25	1.33	1.90	0.10	71	0.67
1.92	0.10	26	1.31	2.00	0.01	72	0.24
1.92	0.10	27	1.29	1.99	0.00	73	0.09
1.92	0.10	28	1.26	2.00	0.00	74	0.04
1.92	0.10	29	1.24	1.98	0.00	75	0.01
1.92	0.10	30	1.23	2.00	0.00	76	0.00
1.92	0.10	31	1.21	2.00	0.00	77	0.00
1.92	0.10	32	1.20	2.00	0.00	78	0.00
1.92	0.10	33	1.19	2.00	0.00	79	0.00
1.92	0.10	34	1.18	2.00	0.00	80	0.00
1.92	0.10	35	1.17	2.00	0.00	81	0.00
1.92	0.10	37	1.15	2.00	0.00	82	0.00
1.92	0.10	38	1.13	2.00	0.00	83	0.00
1.92	0.10	39	1.11	1.99	0.00	84	0.00
1.92	0.10	40	1.09	1.99	0.00	85	0.00
1.92	0.10	41	1.09	1.99	0.00	86	0.00
1.92	0.10	42	1.08	2.00	0.00	87	0.00
1.92	0.10	43	1.09	2.00	0.00	88	0.00
1.92	0.10	44	1.09	1.99	0.00	89	0.00
1.92	0.10	45	1.10	2.00	0.00	90	0.00

Material	Teflon	Temperature	100				
Length	50	Concentration	2				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.00	1.92	0.10	46	0.97
1.99	0.00	1	0.00	1.92	0.10	47	0.96
1.99	0.00	2	0.00	1.92	0.10	48	0.95
1.99	0.00	3	0.00	1.92	0.10	49	1.03
1.99	0.00	4	0.00	1.92	0.10	50	1.12
1.99	0.00	5	0.00	1.92	0.10	51	1.13
1.99	0.00	6	0.00	1.92	0.10	52	1.14
1.99	0.00	7	0.00	1.92	0.10	53	1.15
1.99	0.00	8	0.00	1.92	0.10	54	1.16
1.99	0.00	9	0.00	1.92	0.10	55	1.14
1.92	0.10	10	0.18	1.92	0.10	56	1.12
1.92	0.10	11	0.35	1.92	0.10	57	1.10
1.92	0.10	12	0.80	1.92	0.10	58	1.08
1.92	0.10	13	1.25	1.92	0.10	59	1.00
1.92	0.10	14	1.39	1.92	0.10	60	0.92
1.92	0.10	15	1.52	1.92	0.10	61	0.93
1.92	0.10	16	1.29	1.92	0.10	62	0.94
1.92	0.10	17	1.05	1.92	0.10	63	0.95
1.92	0.10	18	1.11	1.92	0.10	64	0.95
1.92	0.10	19	1.16	1.92	0.10	65	0.95
1.92	0.10	20	1.28	1.92	0.10	66	0.96
1.92	0.10	21	1.41	1.92	0.10	67	0.97
1.92	0.10	22	1.30	1.92	0.10	68	0.97
1.92	0.10	23	1.18	1.92	0.10	69	0.73
1.92	0.10	24	1.13	1.92	0.10	70	0.49
1.92	0.10	25	1.09	1.99	0.01	71	0.13
1.92	0.10	26	1.16	2.00	0.01	72	0.08
1.92	0.10	27	1.22	2.00	0.00	73	0.03
1.92	0.10	28	1.23	1.99	0.00	74	0.01
1.92	0.10	30	1.24	1.99	0.00	75	0.00
1.92	0.10	31	1.22	1.99	0.00	76	0.00
1.92	0.10	32	1.21	1.99	0.00	77	0.00
1.92	0.10	33	1.18	2.00	0.00	78	0.00
1.92	0.10	34	1.16	1.99	0.00	79	0.00
1.92	0.10	35	1.17	2.00	0.00	80	0.00
1.92	0.10	36	1.18	2.00	0.00	81	0.00
1.92	0.10	37	1.19	1.99	0.00	82	0.00
1.92	0.10	38	1.20	1.99	0.00	83	0.00
1.92	0.10	39	1.20	2.00	0.00	84	0.00
1.92	0.10	40	1.20	1.99	0.00	85	0.00
1.92	0.10	41	1.19	1.99	0.00	86	0.00
1.92	0.10	42	1.18	2.00	0.00	87	0.00
1.92	0.10	43	1.16	1.99	0.00	89	0.00
1.92	0.10	44	1.14	2.00	0.00	90	0.00
1.92	0.10	45	1.06	2.00	0.00	91	0.00

Material	Teflon	Temperature	100				
Length	50	Concentration	2				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.00	1.92	0.10	45	1.02
1.99	0.00	1	0.00	1.92	0.10	46	1.00
1.99	0.00	2	0.00	1.92	0.10	47	0.99
1.99	0.00	3	0.00	1.92	0.10	48	0.99
1.99	0.00	4	0.00	1.92	0.10	49	0.99
1.99	0.00	5	0.00	1.92	0.10	50	1.02
1.99	0.00	6	0.00	1.92	0.10	51	1.04
1.99	0.00	7	0.00	1.92	0.10	52	1.12
1.99	0.00	8	0.00	1.92	0.10	54	1.20
1.99	0.00	9	0.00	1.92	0.10	55	1.18
1.92	0.10	10	0.21	1.92	0.10	56	1.17
1.92	0.10	11	0.41	1.92	0.10	57	1.09
1.92	0.10	12	0.74	1.92	0.10	58	1.02
1.92	0.10	13	1.07	1.92	0.10	59	0.88
1.92	0.10	14	1.30	1.92	0.10	60	0.74
1.92	0.10	15	1.54	1.92	0.10	61	0.82
1.92	0.10	16	1.61	1.92	0.10	62	0.89
1.92	0.10	17	1.68	1.92	0.10	63	1.03
1.92	0.10	18	1.62	1.92	0.10	64	1.17
1.92	0.10	19	1.56	1.92	0.10	65	1.09
1.92	0.10	20	1.40	1.92	0.10	66	1.01
1.92	0.10	21	1.25	1.92	0.10	67	1.01
1.92	0.10	22	1.21	1.92	0.10	68	1.01
1.92	0.10	23	1.18	1.92	0.10	69	0.91
1.92	0.10	24	1.25	1.91	0.10	70	0.81
1.92	0.10	25	1.32	2.00	0.01	71	0.27
1.92	0.10	26	1.32	1.99	0.01	72	0.08
1.92	0.10	27	1.32	1.99	0.00	73	0.03
1.92	0.10	28	1.32	2.00	0.00	74	0.01
1.92	0.10	29	1.33	1.99	0.00	75	0.00
1.92	0.10	30	1.32	2.00	0.00	76	0.00
1.92	0.10	31	1.32	2.00	0.00	77	0.00
1.92	0.10	32	1.29	1.99	0.00	78	0.00
1.92	0.10	33	1.25	2.00	0.00	79	0.00
1.92	0.10	34	1.24	2.00	0.00	80	0.00
1.92	0.10	35	1.22	1.99	0.00	81	0.00
1.92	0.10	36	1.24	1.99	0.00	82	0.00
1.92	0.10	37	1.26	2.00	0.00	83	0.00
1.92	0.10	38	1.15	1.99	0.00	84	0.00
1.92	0.10	39	1.05	2.00	0.00	85	0.00
1.92	0.10	40	0.93	1.99	0.00	86	0.00
1.92	0.10	41	0.81	2.00	0.00	87	0.00
1.92	0.10	42	0.90	2.00	0.00	88	0.00
1.92	0.10	43	0.99	1.99	0.00	89	0.00
1.92	0.10	44	1.00	2.00	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	50	Concentration	2				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.00	1.92	0.09	46	1.07
1.99	0.00	1	0.00	1.92	0.09	47	1.07
1.99	0.00	2	0.00	1.92	0.09	48	1.06
1.99	0.00	3	0.00	1.92	0.09	49	1.06
1.99	0.00	4	0.00	1.92	0.09	50	1.05
1.99	0.00	5	0.00	1.92	0.09	51	1.00
1.99	0.00	6	0.00	1.92	0.09	52	0.94
1.99	0.00	7	0.00	1.92	0.09	53	0.91
1.99	0.00	8	0.00	1.92	0.09	54	0.88
1.99	0.00	9	0.00	1.92	0.09	55	0.93
1.92	0.09	10	0.33	1.92	0.09	56	0.98
1.92	0.09	11	0.66	1.92	0.09	57	1.01
1.92	0.09	12	1.10	1.92	0.09	58	1.04
1.92	0.09	13	1.55	1.92	0.09	59	0.98
1.92	0.09	14	1.61	1.92	0.09	60	0.93
1.92	0.09	15	1.68	1.92	0.09	61	0.83
1.92	0.09	16	1.60	1.92	0.09	62	0.73
1.92	0.09	17	1.52	1.92	0.09	63	0.67
1.92	0.09	18	1.35	1.92	0.09	64	0.61
1.92	0.09	19	1.18	1.92	0.09	65	0.70
1.92	0.09	20	0.96	1.92	0.09	66	0.80
1.92	0.09	21	0.75	1.92	0.09	67	0.88
1.92	0.09	22	0.84	1.92	0.09	68	0.96
1.92	0.09	23	0.93	1.92	0.09	69	0.75
1.92	0.09	24	1.08	1.91	0.09	70	0.55
1.92	0.09	25	1.23	2.00	0.02	71	0.13
1.92	0.09	26	1.22	1.99	0.02	72	0.02
1.92	0.09	27	1.21	1.99	0.00	73	0.00
1.92	0.09	28	1.19	1.99	0.00	74	0.00
1.92	0.09	29	1.18	1.99	0.00	75	0.00
1.92	0.09	31	1.16	2.00	0.00	76	0.00
1.92	0.09	32	1.14	2.00	0.00	77	0.00
1.92	0.09	33	1.13	2.00	0.00	78	0.00
1.92	0.09	34	1.13	1.99	0.00	79	0.00
1.92	0.09	35	0.97	2.00	0.00	80	0.00
1.92	0.09	36	0.81	2.00	0.00	81	0.00
1.92	0.09	37	0.70	2.00	0.00	82	0.00
1.92	0.09	38	0.60	2.00	0.00	83	0.00
1.92	0.09	39	0.70	2.00	0.00	84	0.00
1.92	0.09	40	0.80	2.00	0.00	85	0.00
1.92	0.09	41	0.80	2.00	0.00	86	0.00
1.92	0.09	42	0.80	1.99	0.00	87	0.00
1.92	0.09	43	0.85	1.99	0.00	88	0.00
1.92	0.09	44	0.90	1.99	0.00	90	0.00
1.92	0.09	45	0.99	2.00	0.00	91	0.00

Material	Teflon	Temperature	80				
Length	50	Concentration	2				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.00	1.92	0.10	46	1.12
1.99	0.00	1	0.00	1.92	0.10	47	1.12
1.99	0.00	2	0.00	1.92	0.10	48	1.12
1.99	0.00	3	0.00	1.92	0.10	49	1.11
1.99	0.00	4	0.00	1.92	0.10	50	1.10
1.99	0.00	5	0.00	1.92	0.10	51	1.10
1.99	0.00	6	0.00	1.92	0.10	52	1.10
1.99	0.00	7	0.00	1.92	0.10	53	1.09
1.99	0.00	8	0.00	1.92	0.10	54	1.09
1.99	0.00	9	0.02	1.92	0.10	55	1.09
1.92	0.10	10	0.20	1.92	0.10	56	1.09
1.92	0.10	11	0.38	1.92	0.10	57	1.09
1.92	0.10	12	0.78	1.92	0.10	58	1.08
1.92	0.10	13	1.18	1.92	0.10	59	1.08
1.92	0.10	14	1.29	1.92	0.10	60	1.07
1.92	0.10	15	1.40	1.92	0.10	61	0.99
1.92	0.10	16	1.38	1.92	0.10	62	0.90
1.92	0.10	17	1.36	1.92	0.10	63	0.90
1.92	0.10	18	1.42	1.92	0.10	64	0.90
1.92	0.10	19	1.48	1.92	0.10	65	0.85
1.92	0.10	20	1.43	1.92	0.10	66	0.80
1.92	0.10	21	1.38	1.92	0.10	67	0.75
1.92	0.10	22	1.36	1.91	0.10	68	0.71
1.92	0.10	23	1.34	1.91	0.10	69	0.63
1.92	0.10	24	1.33	1.91	0.09	70	0.55
1.92	0.10	25	1.31	2.00	0.02	71	0.11
1.92	0.10	26	1.29	2.00	0.01	72	0.01
1.92	0.10	27	1.27	1.99	0.01	73	0.00
1.92	0.10	28	1.26	2.00	0.00	74	0.00
1.92	0.10	29	1.25	2.00	0.00	75	0.00
1.92	0.10	30	1.15	2.00	0.00	76	0.00
1.92	0.10	31	1.06	1.99	0.00	77	0.00
1.92	0.10	32	1.01	1.99	0.00	78	0.00
1.92	0.10	33	0.96	2.00	0.00	79	0.00
1.92	0.10	34	1.03	1.99	0.00	80	0.00
1.92	0.10	36	1.10	2.00	0.00	81	0.00
1.92	0.10	37	1.12	2.00	0.00	82	0.00
1.92	0.10	38	1.14	2.00	0.00	83	0.00
1.92	0.10	39	1.13	2.00	0.00	84	0.00
1.92	0.10	40	1.12	1.99	0.00	85	0.00
1.92	0.10	41	1.12	1.99	0.00	86	0.00
1.92	0.10	42	1.12	2.00	0.00	87	0.00
1.92	0.10	43	1.12	2.00	0.00	88	0.00
1.92	0.10	44	1.12	2.00	0.00	89	0.00
1.92	0.10	45	1.12	2.00	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	50	Concentration	2				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.00	1.92	0.10	46	0.91
1.99	0.00	1	0.00	1.92	0.10	47	0.91
1.99	0.00	2	0.00	1.92	0.10	48	0.92
1.99	0.00	3	0.00	1.92	0.10	49	1.02
1.99	0.00	4	0.00	1.92	0.10	50	1.12
1.99	0.00	5	0.00	1.92	0.10	51	1.12
1.99	0.00	6	0.00	1.92	0.10	52	1.12
1.99	0.00	7	0.00	1.92	0.10	53	1.12
1.99	0.00	8	0.00	1.92	0.10	54	1.12
1.99	0.00	9	0.00	1.92	0.10	55	1.11
1.92	0.10	10	0.25	1.92	0.10	56	1.10
1.92	0.10	11	0.50	1.92	0.10	57	1.08
1.92	0.10	12	1.00	1.92	0.10	58	1.07
1.92	0.10	13	1.49	1.92	0.10	59	1.07
1.92	0.10	14	1.69	1.92	0.10	60	1.07
1.92	0.10	15	1.89	1.92	0.10	61	1.06
1.92	0.10	16	1.67	1.92	0.10	62	1.05
1.92	0.10	17	1.46	1.92	0.10	63	0.97
1.92	0.10	18	1.40	1.92	0.10	64	0.89
1.92	0.10	19	1.34	1.92	0.10	65	0.91
1.92	0.10	20	1.41	1.92	0.10	66	0.93
1.92	0.10	21	1.49	1.92	0.10	67	0.96
1.92	0.10	22	1.28	1.92	0.10	68	1.00
1.92	0.10	23	1.07	1.92	0.10	69	0.78
1.92	0.10	24	1.05	1.92	0.10	70	0.56
1.92	0.10	25	1.04	2.00	0.03	71	0.12
1.92	0.10	26	1.19	1.99	0.01	72	0.02
1.92	0.10	27	1.33	2.00	0.01	73	0.00
1.92	0.10	28	1.31	2.00	0.00	74	0.00
1.92	0.10	29	1.29	1.99	0.00	75	0.00
1.92	0.10	30	1.27	2.00	0.00	76	0.00
1.92	0.10	32	1.25	2.00	0.00	77	0.00
1.92	0.10	33	1.15	2.00	0.00	78	0.00
1.92	0.10	34	1.05	1.99	0.00	79	0.00
1.92	0.10	35	1.02	2.00	0.00	80	0.00
1.92	0.10	36	0.99	2.00	0.00	81	0.00
1.92	0.10	37	1.06	2.00	0.00	82	0.00
1.92	0.10	38	1.13	2.00	0.00	83	0.00
1.92	0.10	39	1.14	1.99	0.00	84	0.00
1.92	0.10	40	1.15	2.00	0.00	85	0.00
1.92	0.10	41	1.07	1.99	0.00	86	0.00
1.92	0.10	42	0.98	1.99	0.00	87	0.00
1.92	0.10	43	0.96	2.00	0.00	88	0.00
1.92	0.10	44	0.94	2.00	0.00	89	0.00
1.92	0.10	45	0.92	2.00	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	50	Concentration	25				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.98	0.00	0	0.11	0.97	0.97	46	24.24
1.98	0.00	1	0.11	0.97	0.98	47	24.30
1.98	0.00	2	0.11	0.97	0.98	48	24.31
1.98	0.00	3	0.11	0.97	0.97	49	24.35
1.98	0.00	4	0.11	0.97	0.97	50	24.38
1.98	0.00	5	0.11	0.97	0.97	51	24.42
1.98	0.00	6	0.06	0.98	0.97	52	24.45
1.98	0.00	7	0.06	0.98	0.97	53	24.50
1.98	0.00	8	0.06	0.98	0.97	54	24.50
1.98	0.00	9	0.48	0.98	0.97	55	24.54
0.97	0.97	10	4.11	0.97	0.97	56	24.58
0.97	0.97	11	7.74	0.98	0.98	57	24.62
0.97	0.97	12	11.35	0.98	0.97	58	24.65
0.97	0.97	13	14.96	0.98	0.97	59	24.69
0.97	0.97	14	19.29	0.98	0.97	60	24.70
0.97	0.97	15	23.62	0.98	0.97	61	24.76
0.97	0.97	16	23.65	0.98	0.97	62	24.81
0.97	0.97	17	23.69	0.98	0.97	63	24.82
0.97	0.97	18	23.71	0.97	0.97	64	24.85
0.97	0.97	19	23.72	0.98	0.98	65	24.88
0.97	0.97	20	23.74	0.98	0.97	66	24.91
0.97	0.97	21	23.75	0.97	0.97	67	24.95
0.97	0.97	22	23.75	0.97	0.97	68	24.97
0.97	0.97	23	23.76	0.98	0.97	69	24.99
0.97	0.97	24	23.78	0.98	0.98	70	14.83
0.97	0.97	25	23.81	0.97	0.98	71	7.04
0.97	0.97	26	23.82	1.97	0.06	72	2.72
0.97	0.97	27	23.83	1.97	0.06	73	1.12
0.97	0.97	28	23.85	1.97	0.00	74	0.55
0.97	0.97	29	23.86	1.97	0.00	75	0.53
0.97	0.97	30	23.87	1.97	0.00	76	0.30
0.97	0.97	32	23.89	1.97	0.00	77	0.37
0.97	0.97	33	23.92	1.97	0.00	78	0.22
0.97	0.97	34	23.95	1.97	0.00	79	0.27
0.97	0.97	35	23.96	1.97	0.00	80	0.17
0.97	0.97	36	23.97	1.97	0.00	81	0.24
0.97	0.97	37	24.00	1.97	0.00	82	0.14
0.97	0.97	38	24.03	1.97	0.00	83	0.19
0.97	0.97	39	24.03	1.97	0.00	84	0.11
0.97	0.97	40	24.04	1.97	0.00	85	0.14
0.97	0.97	41	24.06	1.97	0.00	86	0.10
0.98	0.97	42	24.09	1.97	0.00	87	0.14
0.98	0.97	43	24.13	1.97	0.00	88	0.10
0.98	0.97	44	24.16	1.97	0.00	89	0.15
0.97	0.97	45	24.22	1.97	0.00	90	0.10

Material	Teflon	Temperature	80				
Length	50	Concentration	25				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.12	0.98	0.97	46	23.75
1.97	0.00	1	0.12	0.98	0.97	47	23.76
1.97	0.00	2	0.12	0.98	0.97	48	23.81
1.97	0.00	3	0.07	0.98	0.97	49	23.83
1.97	0.00	4	0.07	0.97	0.97	50	23.85
1.97	0.00	5	0.07	0.98	0.98	51	23.85
1.97	0.00	6	0.07	0.97	0.97	52	23.87
1.97	0.00	7	0.07	0.98	0.98	53	23.90
1.97	0.00	8	0.07	0.98	0.97	54	23.94
1.97	0.00	9	0.07	0.98	0.98	55	23.95
0.98	0.98	10	0.56	0.98	0.98	56	23.96
0.98	0.98	11	1.05	0.98	0.97	57	23.99
0.98	0.98	12	5.42	0.98	0.97	58	24.03
0.98	0.98	13	7.60	0.98	0.98	59	24.06
0.98	0.98	14	8.69	0.98	0.97	60	24.06
0.98	0.98	15	9.78	0.98	0.97	61	24.07
0.98	0.98	16	13.85	0.98	0.98	62	24.09
0.98	0.98	17	17.92	0.98	0.97	63	24.12
0.98	0.98	18	20.92	0.98	0.98	64	24.15
0.98	0.98	19	23.91	0.98	0.97	65	24.17
0.98	0.98	20	23.87	0.97	0.98	66	24.17
0.98	0.98	21	23.83	0.98	0.97	67	24.20
0.98	0.98	22	23.81	0.97	0.97	68	24.21
0.98	0.98	23	23.78	0.98	0.98	69	24.24
0.98	0.98	24	23.74	0.98	0.98	70	24.24
0.98	0.98	25	23.70	1.97	0.00	71	24.25
0.98	0.98	26	23.69	1.97	0.00	72	24.26
0.98	0.98	27	23.68	1.97	0.00	73	20.51
0.98	0.98	28	23.67	1.97	0.00	74	16.76
0.98	0.98	29	23.67	1.97	0.00	75	12.55
0.98	0.98	30	23.67	1.97	0.00	76	8.35
0.98	0.98	31	23.68	1.97	0.00	77	4.75
0.98	0.98	32	23.66	1.97	0.00	78	1.15
0.98	0.98	33	23.64	1.97	0.00	79	0.86
0.98	0.98	35	23.63	1.97	0.00	80	0.56
0.98	0.98	36	23.63	1.97	0.00	81	0.48
0.98	0.98	37	23.63	1.97	0.00	82	0.40
0.98	0.98	38	23.63	1.97	0.00	83	0.35
0.98	0.98	39	23.63	1.97	0.00	84	0.30
0.98	0.98	40	23.64	1.97	0.00	85	0.27
0.98	0.97	41	23.64	1.97	0.00	86	0.25
0.98	0.98	42	23.68	1.97	0.00	87	0.24
0.98	0.98	43	23.69	1.97	0.00	88	0.22
0.98	0.97	44	23.70	1.97	0.00	89	0.20
0.98	0.98	45	23.72	1.97	0.00	90	0.17

Material	Teflon	Temperature	80				
Length	50	Concentration	25				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.12	0.98	0.98	45	24.27
1.97	0.00	1	0.12	0.98	0.98	46	24.27
1.97	0.00	2	0.12	0.98	0.98	47	24.27
1.97	0.00	3	0.12	0.98	0.98	48	24.27
1.97	0.00	4	0.12	0.98	0.98	49	24.26
1.97	0.00	5	0.07	0.98	0.98	50	24.27
1.97	0.00	6	0.07	0.98	0.98	51	24.28
1.97	0.00	7	0.07	0.98	0.98	52	24.28
1.97	0.00	8	0.07	0.98	0.98	53	24.29
1.97	0.00	9	0.07	0.98	0.98	54	24.31
0.98	0.98	10	0.58	0.98	0.98	56	24.32
0.98	0.98	11	1.08	0.98	0.98	57	24.32
0.98	0.98	12	3.44	0.98	0.98	58	24.33
0.98	0.98	13	5.79	0.98	0.98	59	24.34
0.98	0.98	14	8.14	0.98	0.98	60	24.34
0.98	0.98	15	10.49	0.98	0.98	61	24.36
0.98	0.98	16	17.39	0.98	0.98	62	24.37
0.98	0.98	17	24.28	0.98	0.98	63	24.37
0.98	0.98	18	24.46	0.98	0.98	64	24.38
0.98	0.98	19	24.63	0.98	0.97	65	24.59
0.98	0.98	20	24.58	0.98	0.97	66	24.61
0.98	0.98	21	24.53	0.98	0.98	67	24.63
0.98	0.98	22	24.48	0.98	0.97	68	24.66
0.98	0.98	23	24.43	0.98	0.97	69	24.69
0.98	0.98	24	24.41	0.98	0.97	70	24.72
0.98	0.98	25	24.38	1.97	0.00	71	18.30
0.98	0.98	26	24.36	1.97	0.00	72	13.68
0.98	0.98	27	24.33	1.97	0.00	73	9.07
0.98	0.98	28	24.32	1.97	0.00	74	5.05
0.98	0.98	29	24.32	1.97	0.00	75	1.03
0.98	0.98	30	24.29	1.97	0.00	76	0.80
0.98	0.98	31	24.27	1.97	0.00	77	0.57
0.98	0.98	32	24.27	1.97	0.00	78	0.49
0.98	0.98	33	24.27	1.97	0.00	79	0.41
0.98	0.98	34	24.26	1.97	0.00	80	0.37
0.98	0.98	35	24.25	1.97	0.00	81	0.32
0.98	0.98	36	24.26	1.97	0.00	82	0.29
0.98	0.98	37	24.27	1.97	0.00	83	0.27
0.98	0.98	38	24.27	1.97	0.00	84	0.25
0.98	0.98	39	24.28	1.97	0.00	85	0.24
0.98	0.98	40	24.28	1.97	0.00	86	0.20
0.98	0.98	41	24.28	1.97	0.00	87	0.15
0.98	0.98	42	24.27	1.97	0.00	88	0.15
0.98	0.98	43	24.27	1.97	0.00	89	0.15
0.98	0.98	44	24.27	1.97	0.00	90	0.15

Material	Teflon	Temperature	80				
Length	50	Concentration	35				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.01	0.56	1.38	45	34.65
1.97	0.00	1	0.01	0.56	1.38	46	34.45
1.97	0.00	2	0.01	0.56	1.38	47	34.26
1.97	0.00	3	0.04	0.56	1.38	48	34.78
1.97	0.00	4	0.04	0.56	1.38	49	35.30
1.97	0.00	5	0.04	0.56	1.38	51	35.36
1.97	0.00	6	0.04	0.56	1.38	52	35.43
1.97	0.00	7	0.04	0.56	1.38	53	35.26
1.97	0.00	8	0.04	0.56	1.38	54	35.09
1.97	0.00	9	0.04	0.56	1.38	55	35.14
0.56	1.38	10	3.89	0.56	1.38	56	35.18
0.56	1.38	11	7.75	0.56	1.38	57	34.94
0.56	1.38	12	20.99	0.56	1.38	58	34.69
0.56	1.38	13	34.23	0.56	1.38	59	34.93
0.56	1.38	14	34.38	0.56	1.38	60	35.16
0.56	1.38	15	34.53	0.56	1.38	61	35.20
0.56	1.38	16	34.59	0.56	1.38	62	35.24
0.56	1.38	17	34.66	0.56	1.38	63	34.95
0.56	1.38	18	34.70	0.56	1.38	64	34.66
0.56	1.38	19	34.73	0.56	1.38	65	34.61
0.56	1.38	20	34.78	0.56	1.38	66	34.57
0.56	1.38	21	34.82	0.56	1.38	67	34.71
0.56	1.38	22	34.85	0.56	1.38	68	34.86
0.56	1.38	23	34.89	0.56	1.38	69	34.42
0.56	1.38	24	34.77	0.56	1.38	70	33.99
0.56	1.38	25	34.65	1.97	0.06	71	5.31
0.56	1.38	26	33.61	1.97	0.04	72	0.68
0.56	1.38	27	32.56	2.00	0.03	73	0.42
0.56	1.38	28	32.20	1.96	0.01	74	0.28
0.56	1.38	29	31.83	1.97	0.00	75	0.23
0.56	1.38	30	32.95	1.98	0.00	76	0.18
0.56	1.38	31	34.06	1.97	0.00	77	0.14
0.56	1.38	32	34.41	1.97	0.00	78	0.12
0.56	1.38	33	34.76	1.98	0.00	79	0.07
0.56	1.38	34	34.91	1.97	0.00	80	0.04
0.56	1.38	35	35.07	1.97	0.00	81	0.04
0.56	1.38	36	34.47	1.98	0.00	82	0.05
0.56	1.38	37	33.88	1.97	0.00	83	0.05
0.56	1.38	38	33.39	1.97	0.00	84	0.04
0.56	1.38	39	32.91	1.98	0.00	85	0.03
0.56	1.38	40	32.94	1.97	0.00	86	0.04
0.56	1.38	41	32.96	1.97	0.00	87	0.05
0.56	1.38	42	33.16	1.97	0.00	88	0.04
0.56	1.38	43	33.35	1.97	0.00	89	0.01
0.56	1.38	44	34.00	1.97	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	50	Concentration	35				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.00	0.56	1.38	46	35.71
1.97	0.00	1	0.00	0.56	1.38	47	33.86
1.97	0.00	2	0.00	0.56	1.38	48	32.01
1.97	0.00	3	0.00	0.56	1.38	49	32.18
1.97	0.00	4	0.00	0.56	1.38	50	32.34
1.97	0.00	5	0.00	0.56	1.38	51	33.60
1.97	0.00	6	0.00	0.56	1.38	52	34.85
1.97	0.00	7	0.00	0.56	1.38	53	35.04
1.97	0.00	8	0.00	0.56	1.38	54	35.24
1.97	0.00	9	0.00	0.56	1.38	55	35.00
0.56	1.38	10	0.70	0.56	1.38	56	34.77
0.56	1.38	11	2.09	0.56	1.38	57	34.04
0.56	1.38	12	3.86	0.56	1.38	58	33.32
0.56	1.38	13	9.48	0.56	1.38	59	33.58
0.56	1.38	14	21.79	0.56	1.38	60	33.85
0.56	1.38	15	34.10	0.56	1.38	61	34.40
0.56	1.38	16	34.36	0.56	1.38	62	34.95
0.56	1.38	17	34.62	0.56	1.38	63	34.78
0.56	1.38	18	35.04	0.56	1.38	64	34.62
0.56	1.38	19	35.45	0.56	1.38	65	34.80
0.56	1.38	20	35.63	0.56	1.38	66	34.98
0.56	1.38	21	35.81	0.56	1.38	67	34.98
0.56	1.38	22	35.28	0.56	1.38	68	34.97
0.56	1.38	23	34.75	0.56	1.38	69	33.97
0.56	1.38	24	34.96	0.56	1.38	70	32.97
0.56	1.38	25	35.16	1.97	0.06	71	7.23
0.56	1.38	26	34.62	1.98	0.06	72	1.71
0.56	1.38	27	34.08	1.98	0.03	73	0.93
0.56	1.38	28	34.36	1.97	0.01	74	0.48
0.56	1.38	29	34.63	1.97	0.00	75	0.29
0.56	1.38	30	34.63	1.97	0.00	76	0.20
0.56	1.38	31	34.63	1.97	0.00	77	0.16
0.56	1.38	32	35.08	1.97	0.00	78	0.11
0.56	1.38	33	35.53	1.97	0.00	79	0.14
0.56	1.38	34	34.97	1.97	0.00	80	0.14
0.56	1.38	35	34.41	1.97	0.00	81	0.11
0.56	1.38	37	34.53	1.97	0.00	82	0.05
0.56	1.38	38	34.65	1.98	0.00	83	0.04
0.56	1.38	39	34.74	1.97	0.00	84	0.05
0.56	1.38	40	34.83	1.97	0.00	85	0.05
0.56	1.38	41	35.26	1.97	0.00	86	0.05
0.56	1.38	42	35.68	1.97	0.00	87	0.03
0.56	1.38	43	35.79	1.97	0.00	88	0.03
0.56	1.38	44	35.90	1.97	0.00	89	0.05
0.56	1.38	45	35.81	1.97	0.00	90	0.03

Material	Teflon	Temperature	80				
Length	50	Concentration	35				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.00	0.56	1.38	46	34.08
1.97	0.00	1	0.00	0.56	1.38	47	32.32
1.97	0.00	2	0.00	0.56	1.38	48	30.56
1.97	0.00	3	0.00	0.56	1.38	49	29.78
1.97	0.00	4	0.00	0.56	1.38	50	29.00
1.97	0.00	5	0.00	0.56	1.38	51	29.02
1.97	0.00	6	0.00	0.56	1.38	52	29.04
1.97	0.00	7	0.00	0.56	1.38	53	28.95
1.97	0.00	8	0.00	0.56	1.38	54	28.85
1.97	0.00	9	0.00	0.56	1.38	55	30.15
0.56	1.38	10	0.69	0.56	1.38	56	31.45
0.56	1.38	11	1.37	0.56	1.38	57	33.23
0.56	1.38	12	5.63	0.56	1.38	58	34.21
0.56	1.38	13	9.89	0.56	1.38	59	35.49
0.56	1.38	14	22.67	0.56	1.38	60	35.19
0.56	1.38	15	35.46	0.56	1.38	61	35.38
0.56	1.38	16	35.44	0.56	1.38	62	35.73
0.56	1.38	17	34.11	0.56	1.38	63	34.56
0.56	1.38	18	34.30	0.56	1.38	64	35.92
0.56	1.38	19	35.38	0.56	1.38	65	35.99
0.56	1.38	20	35.47	0.56	1.38	66	34.11
0.56	1.38	21	35.02	0.56	1.38	67	34.65
0.56	1.38	22	34.87	0.56	1.38	68	34.75
0.56	1.38	23	34.49	0.56	1.38	69	35.20
0.56	1.38	24	34.31	0.56	1.38	70	35.32
0.56	1.38	25	35.02	1.98	0.07	71	34.59
0.56	1.38	26	34.56	1.97	0.05	72	7.34
0.56	1.38	27	34.11	1.97	0.03	73	1.03
0.56	1.38	28	34.03	1.97	0.02	74	0.30
0.56	1.38	29	33.94	1.97	0.00	75	0.26
0.56	1.38	30	34.47	1.97	0.00	76	0.28
0.56	1.38	31	35.80	1.97	0.00	77	0.23
0.56	1.38	32	35.86	1.97	0.00	78	0.18
0.56	1.38	33	34.11	1.97	0.00	79	0.14
0.56	1.38	34	35.76	1.97	0.00	80	0.14
0.56	1.38	35	34.07	1.97	0.00	81	0.09
0.56	1.38	37	34.66	1.97	0.00	82	0.07
0.56	1.38	38	34.32	1.97	0.00	83	0.05
0.56	1.38	39	33.01	1.97	0.00	84	0.04
0.56	1.38	40	31.69	1.97	0.00	85	0.05
0.56	1.38	41	32.38	1.97	0.00	86	0.04
0.56	1.38	42	33.07	1.97	0.00	87	0.04
0.56	1.38	43	34.04	1.97	0.00	88	0.05
0.56	1.38	44	35.17	1.97	0.00	89	0.05
0.56	1.38	45	34.54	1.97	0.00	90	0.03

Material	Teflon	Temperature	80				
Length	150	Concentration	2				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.02	1.92	0.09	45	#REF!
2.00	0.00	1	0.02	1.92	0.09	46	0.74
2.00	0.00	2	0.03	1.92	0.09	47	0.83
2.00	0.00	3	0.03	1.92	0.09	48	0.93
2.00	0.00	4	0.00	1.92	0.09	49	0.92
2.00	0.00	5	0.00	1.92	0.09	50	0.90
2.00	0.00	6	0.00	1.92	0.09	51	0.91
2.00	0.00	7	0.00	1.92	0.09	52	0.91
2.00	0.00	8	0.00	1.92	0.09	53	0.92
1.94	0.09	9	0.01	1.92	0.09	54	0.94
1.94	0.09	10	0.02	1.92	0.09	55	0.94
1.92	0.09	11	0.25	1.92	0.09	56	0.94
1.92	0.09	12	0.48	1.92	0.09	57	0.94
1.92	0.09	13	0.74	1.92	0.09	58	0.94
1.92	0.09	14	1.01	1.92	0.09	59	0.93
1.92	0.09	15	1.04	1.92	0.09	60	0.93
1.92	0.09	16	1.08	1.92	0.09	61	0.93
1.92	0.09	17	1.00	1.92	0.09	62	0.93
1.92	0.09	18	0.92	1.92	0.09	63	0.86
1.92	0.09	19	0.93	1.92	0.09	64	0.78
1.92	0.09	20	0.94	1.92	0.09	65	0.78
1.92	0.09	21	0.99	1.92	0.09	66	0.77
1.92	0.09	22	1.03	1.92	0.09	67	0.83
1.92	0.09	23	1.02	1.92	0.10	68	0.89
1.92	0.09	24	1.01	1.99	0.08	69	0.55
1.92	0.09	25	1.00	2.00	0.02	70	0.17
1.92	0.09	26	0.98	1.99	0.01	71	0.06
1.92	0.09	27	0.97	2.00	0.00	72	0.02
1.92	0.09	28	0.96	2.00	0.00	73	0.00
1.92	0.09	29	0.96	2.00	0.00	74	0.00
1.92	0.09	30	0.95	2.00	0.00	75	0.00
1.92	0.09	31	0.93	1.99	0.00	76	0.00
1.92	0.09	32	0.90	2.00	0.00	77	0.00
1.92	0.09	33	0.83	2.00	0.00	78	0.00
1.92	0.09	34	0.76	2.00	0.00	79	0.00
1.92	0.09	35	0.77	2.00	0.00	80	0.00
1.92	0.09	36	0.79	2.00	0.00	81	0.00
1.92	0.09	37	0.85	2.00	0.00	82	0.00
1.92	0.09	38	0.91	1.99	0.00	83	0.00
1.92	0.09	39	0.90	1.99	0.00	84	0.00
1.92	0.09	40	0.90	2.00	0.00	85	0.00
1.92	0.09	41	0.88	2.00	0.00	86	0.00
1.92	0.09	42	0.86	2.00	0.00	87	0.00
1.92	0.09	43	e	1.99	0.00	88	0.00

Material	Teflon	Temperature	80				
Length	150	Concentration	2				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.00	1.92	0.09	45	0.86
2.00	0.00	1	0.00	1.92	0.09	46	0.94
1.99	0.00	2	0.00	1.92	0.09	47	1.02
1.99	0.00	3	0.00	1.92	0.09	48	1.01
1.99	0.00	4	0.00	1.92	0.09	49	0.99
1.99	0.00	5	0.00	1.92	0.09	50	1.00
1.99	0.00	6	0.00	1.92	0.09	51	1.00
1.99	0.00	7	0.00	1.92	0.09	52	1.00
1.99	0.00	8	0.00	1.92	0.09	53	1.00
1.99	0.00	9	0.00	1.92	0.09	54	1.00
1.92	0.09	10	0.16	1.92	0.09	55	0.99
1.92	0.09	11	0.49	1.92	0.09	56	0.58
1.92	0.09	12	0.42	1.92	0.09	57	0.54
1.92	0.09	13	0.76	1.92	0.09	58	0.49
1.92	0.09	14	0.52	1.92	0.09	59	0.54
1.92	0.09	15	0.81	1.92	0.09	60	0.59
1.92	0.09	16	1.00	1.92	0.09	61	1.03
1.92	0.09	17	1.19	1.92	0.09	62	1.03
1.92	0.09	18	1.25	1.92	0.09	63	1.03
1.92	0.09	19	1.30	1.92	0.09	64	0.98
1.92	0.09	20	1.23	1.92	0.09	66	0.93
1.92	0.09	21	1.15	1.92	0.09	67	0.80
1.92	0.09	22	1.02	1.92	0.09	68	0.67
1.92	0.09	23	0.89	1.92	0.09	69	0.51
1.92	0.09	24	0.76	1.92	0.09	70	0.35
1.92	0.09	25	0.62	2.00	0.02	71	0.11
1.92	0.09	26	0.71	2.00	0.01	72	0.04
1.92	0.09	27	0.79	2.00	0.00	73	0.02
1.92	0.09	28	0.94	2.00	0.00	74	0.00
1.92	0.09	29	1.09	2.00	0.00	75	0.00
1.92	0.09	30	1.04	2.00	0.00	76	0.00
1.92	0.09	31	0.99	2.00	0.00	77	0.00
1.92	0.09	32	0.90	2.00	0.00	78	0.00
1.92	0.09	33	0.81	2.00	0.00	79	0.00
1.92	0.09	34	0.78	2.00	0.00	80	0.00
1.92	0.09	35	0.75	2.00	0.00	81	0.00
1.92	0.09	36	0.84	2.00	0.00	82	0.00
1.92	0.09	37	0.93	2.00	0.00	83	0.00
1.92	0.09	38	0.84	2.00	0.00	84	0.00
1.92	0.09	39	0.75	2.00	0.00	85	0.00
1.92	0.09	40	0.75	2.00	0.00	86	0.00
1.92	0.09	41	0.75	1.99	0.00	87	0.00
1.92	0.09	42	0.81	1.99	0.00	88	0.00
1.92	0.09	43	0.86	1.99	0.00	89	0.00
1.92	0.09	44	0.86	2.00	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	150	Concentration	2				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.00	1.92	0.09	46	0.88
2.00	0.00	1	0.00	1.92	0.09	47	0.87
2.00	0.00	2	0.00	1.92	0.09	48	0.87
2.00	0.00	3	0.00	1.92	0.09	49	0.95
2.00	0.00	4	0.00	1.92	0.09	50	1.03
2.00	0.00	5	0.00	1.92	0.09	51	1.03
2.00	0.00	6	0.00	1.92	0.09	52	1.04
2.00	0.00	7	0.00	1.92	0.09	53	1.06
2.00	0.00	8	0.00	1.92	0.09	54	1.07
2.00	0.00	9	0.00	1.92	0.09	55	1.04
1.92	0.09	10	0.30	1.92	0.09	56	1.00
1.92	0.09	11	0.59	1.92	0.09	57	0.93
1.92	0.09	12	0.79	1.92	0.09	58	0.87
1.92	0.09	13	0.99	1.92	0.09	59	0.91
1.92	0.09	14	1.02	1.92	0.09	60	0.96
1.92	0.09	15	1.06	1.92	0.09	61	1.02
1.92	0.09	16	1.16	1.92	0.09	62	1.08
1.92	0.09	17	1.26	1.92	0.09	63	1.07
1.92	0.09	18	1.26	1.92	0.09	64	1.06
1.92	0.09	19	1.25	1.92	0.09	65	1.05
1.92	0.09	20	1.28	1.92	0.09	66	1.04
1.92	0.09	21	1.30	1.92	0.09	67	1.02
1.92	0.09	22	1.30	1.92	0.09	68	1.00
1.92	0.09	23	1.29	1.92	0.09	69	0.80
1.92	0.09	24	1.28	1.92	0.09	70	0.59
1.92	0.09	25	1.26	2.00	0.09	71	0.12
1.92	0.09	26	1.25	2.00	0.02	72	0.03
1.92	0.09	27	1.24	2.00	0.00	73	0.01
1.92	0.09	28	1.21	1.99	0.00	74	0.00
1.92	0.09	29	1.18	1.99	0.00	75	0.00
1.92	0.09	30	1.05	1.99	0.00	76	0.00
1.92	0.09	31	0.92	2.00	0.00	77	0.00
1.92	0.09	32	0.92	2.00	0.00	78	0.00
1.92	0.09	33	0.92	2.00	0.00	79	0.00
1.92	0.09	34	1.01	2.00	0.00	80	0.00
1.92	0.09	36	1.10	2.00	0.00	81	0.00
1.92	0.09	37	1.09	2.00	0.00	82	0.00
1.92	0.09	38	1.07	2.00	0.00	83	0.00
1.92	0.09	39	1.08	2.00	0.00	84	0.00
1.92	0.09	40	1.09	2.00	0.00	85	0.00
1.92	0.09	41	1.09	1.99	0.00	86	0.00
1.92	0.09	42	1.10	2.00	0.00	87	0.00
1.92	0.09	43	1.08	2.00	0.00	88	0.00
1.92	0.09	44	1.07	2.00	0.00	89	0.00
1.92	0.09	45	0.97	1.99	0.00	90	0.00

Material	Teflon	Temperature	80				
Length	150	Concentration	25				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.05	0.98	0.97	45	24.05
2.00	0.00	1	0.05	0.97	0.97	46	24.07
1.97	0.00	2	0.05	0.98	0.98	47	24.12
1.97	0.00	3	0.05	0.97	0.97	48	24.17
1.97	0.00	4	0.05	0.98	0.97	49	24.24
1.97	0.00	5	0.05	0.97	0.97	50	24.27
1.97	0.00	6	0.05	0.97	0.98	51	24.30
1.97	0.00	7	0.05	0.98	0.97	52	24.33
1.97	0.00	8	0.05	0.97	0.97	53	24.37
1.97	0.00	9	0.64	0.98	0.97	54	24.42
0.97	0.97	10	3.70	0.97	0.97	55	24.46
0.97	0.97	11	6.75	0.98	0.98	56	24.51
0.97	0.97	12	10.18	0.97	0.97	57	24.57
0.97	0.97	13	13.61	0.98	0.97	58	24.59
0.97	0.97	14	18.27	0.97	0.97	59	24.65
0.97	0.97	15	22.93	0.98	0.97	60	24.68
0.97	0.97	16	23.04	0.97	0.98	61	24.74
0.97	0.97	17	23.15	0.98	0.97	62	24.77
0.97	0.97	18	23.19	0.98	0.98	63	24.82
0.97	0.97	19	23.24	0.98	0.97	64	24.85
0.97	0.97	20	23.29	0.98	0.98	65	24.89
0.97	0.97	21	23.34	0.97	0.97	66	24.89
0.97	0.97	22	23.37	0.98	0.97	67	24.94
0.97	0.97	23	23.41	0.97	0.97	68	24.98
0.97	0.97	24	23.43	0.97	0.97	69	24.00
0.97	0.97	25	23.45	1.98	0.00	70	13.05
0.97	0.97	26	23.47	1.98	0.00	71	2.10
0.97	0.97	27	23.49	1.98	0.00	72	1.60
0.97	0.97	28	23.52	1.98	0.00	73	1.10
0.97	0.97	29	23.54	1.98	0.00	74	0.96
0.97	0.97	30	23.57	1.98	0.00	75	0.83
0.97	0.97	31	23.59	1.98	0.00	76	0.75
0.97	0.97	32	23.61	1.98	0.00	77	0.67
0.97	0.97	33	23.64	1.98	0.00	78	0.62
0.97	0.97	34	23.67	1.98	0.00	79	0.57
0.97	0.97	35	23.69	1.98	0.00	80	0.53
0.97	0.97	36	23.72	1.98	0.00	81	0.50
0.97	0.97	37	23.74	1.98	0.00	82	0.47
0.97	0.97	38	23.78	1.98	0.00	83	0.45
0.97	0.97	39	23.81	1.98	0.00	84	0.42
0.97	0.97	40	23.83	1.98	0.00	85	0.38
0.99	0.97	41	23.90	1.98	0.00	86	0.35
0.97	0.97	42	23.95	1.98	0.00	87	0.33
0.98	0.97	43	23.97	1.98	0.00	88	0.31
0.97	0.97	44	23.99	1.98	0.00	89	0.30

Material	Teflon	Temperature	80				
Length	150	Concentration	25				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.24	0.98	0.97	45	24.14
1.97	0.00	1	0.24	0.97	0.97	46	24.16
1.97	0.00	2	0.24	0.98	0.97	47	24.16
1.97	0.00	3	0.24	0.97	0.97	48	24.22
1.97	0.00	4	0.24	0.98	0.97	49	24.24
1.97	0.00	5	0.24	0.98	0.98	50	24.26
1.97	0.00	6	0.24	0.97	0.98	51	24.29
1.97	0.00	7	0.80	0.97	0.98	52	24.31
1.97	0.00	8	0.80	0.98	0.98	53	24.32
1.97	0.00	9	0.80	0.97	0.97	54	24.36
0.98	0.97	10	4.23	0.98	0.97	55	24.37
0.98	0.97	11	7.65	0.97	0.97	56	24.41
0.98	0.97	12	11.71	0.98	0.97	57	24.43
0.98	0.97	13	15.76	0.98	0.97	58	24.45
0.98	0.97	14	19.79	0.98	0.97	59	24.50
0.98	0.97	15	23.81	0.98	0.98	60	24.53
0.98	0.97	16	23.85	0.98	0.97	61	24.54
0.98	0.97	17	23.89	0.98	0.97	62	24.57
0.98	0.97	18	23.89	0.98	0.97	63	24.58
0.98	0.97	19	23.90	0.97	0.97	64	24.60
0.98	0.97	20	23.90	0.97	0.97	65	24.63
0.98	0.97	21	23.89	0.98	0.97	66	24.63
0.98	0.97	22	23.89	0.97	0.98	67	24.68
0.98	0.97	23	23.88	0.98	0.97	68	24.71
0.98	0.97	24	23.90	0.97	0.97	69	23.68
0.98	0.97	25	23.92	1.97	0.00	70	16.87
0.98	0.97	26	23.91	1.97	0.00	71	10.06
0.98	0.97	27	23.90	1.97	0.00	72	6.29
0.98	0.97	28	23.91	1.97	0.00	73	2.53
0.98	0.97	29	23.91	1.97	0.00	74	1.87
0.98	0.97	30	23.92	1.97	0.00	75	1.22
0.98	0.97	31	23.92	1.97	0.00	76	1.06
0.98	0.97	32	23.93	1.97	0.00	77	0.91
0.98	0.97	33	23.94	1.97	0.00	78	0.82
0.98	0.97	34	23.94	1.97	0.00	79	0.74
0.98	0.97	35	23.94	1.97	0.00	80	0.69
0.98	0.97	36	23.96	1.97	0.00	81	0.64
0.98	0.97	37	23.98	1.97	0.00	82	0.60
0.98	0.97	38	23.98	1.97	0.00	83	0.57
0.98	0.97	39	23.98	1.97	0.00	84	0.54
0.98	0.97	40	24.01	1.97	0.00	85	0.51
0.98	0.97	41	24.02	1.97	0.00	86	0.49
0.98	0.97	42	24.08	1.97	0.00	87	0.47
0.98	0.98	43	24.08	1.97	0.00	88	0.44
0.98	0.97	44	24.12	1.97	0.00	89	0.42

Material	Teflon	Temperature	80				
Length	150	Concentration	25				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.33	0.97	0.97	45	24.05
1.97	0.00	1	0.33	0.98	0.98	46	24.05
1.97	0.00	2	0.33	0.98	0.97	47	24.07
1.97	0.00	3	0.33	0.98	0.98	48	24.09
1.97	0.00	4	0.33	0.98	0.97	49	24.10
1.97	0.00	5	0.29	0.98	0.97	50	24.13
1.97	0.00	6	0.29	0.98	0.97	51	24.15
1.97	0.00	7	0.29	0.98	0.97	52	24.17
1.97	0.00	8	0.29	0.98	0.97	53	24.19
1.97	0.00	9	0.29	0.98	0.97	54	24.20
0.98	0.97	10	3.52	0.98	0.98	56	24.23
0.98	0.97	11	6.75	0.98	0.97	57	24.26
0.98	0.97	12	11.44	0.98	0.97	58	24.29
0.98	0.97	13	16.12	0.98	0.97	59	24.33
0.98	0.97	14	20.00	0.98	0.97	60	24.34
0.98	0.97	15	23.87	0.98	0.97	61	24.36
0.98	0.97	16	23.89	0.98	0.97	62	24.36
0.98	0.97	17	23.91	0.97	0.97	63	24.40
0.98	0.97	18	23.93	0.98	0.98	64	24.40
0.98	0.97	19	23.94	0.97	0.97	65	24.41
0.98	0.97	20	23.93	0.97	0.97	66	24.42
0.98	0.97	21	23.92	0.98	0.97	67	24.46
0.98	0.97	22	23.91	0.98	0.97	68	24.47
0.98	0.97	23	23.90	0.97	0.97	69	24.50
0.98	0.97	24	23.89	0.98	0.97	70	18.53
0.98	0.97	25	23.88	1.97	0.00	71	14.53
0.98	0.97	26	23.88	1.97	0.00	72	10.54
0.98	0.97	27	23.89	1.97	0.00	73	6.63
0.98	0.97	28	23.88	1.97	0.00	74	2.71
0.98	0.97	29	23.87	1.97	0.00	75	1.99
0.98	0.97	30	23.88	1.97	0.00	76	1.28
0.98	0.97	31	23.89	1.97	0.00	77	1.12
0.98	0.97	32	23.89	1.97	0.00	78	0.96
0.98	0.97	33	23.90	1.97	0.00	79	0.87
0.98	0.97	34	23.91	1.97	0.00	80	0.79
0.98	0.97	35	23.91	1.97	0.00	81	0.73
0.98	0.97	36	23.91	1.97	0.00	82	0.67
0.98	0.97	37	23.91	1.97	0.00	83	0.64
0.98	0.97	38	23.93	1.97	0.00	84	0.61
0.98	0.97	39	23.95	1.97	0.00	85	0.58
0.98	0.97	40	23.97	1.97	0.00	86	0.55
0.98	0.97	41	23.99	1.97	0.00	87	0.52
0.98	0.98	42	23.99	1.97	0.00	88	0.49
0.98	0.98	43	24.02	1.97	0.00	89	0.46
0.98	0.97	44	24.02	1.97	0.00	90	0.46

Material	Teflon	Temperature	80				
Length	150	Concentration	35				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.00	0.56	1.38	45	34.56
1.97	0.00	1	0.00	0.56	1.38	46	35.01
1.97	0.00	2	0.00	0.56	1.38	47	35.45
1.97	0.00	3	0.00	0.56	1.38	48	34.03
1.97	0.00	4	0.00	0.56	1.38	49	32.62
1.97	0.00	5	0.00	0.56	1.38	50	28.95
1.97	0.00	6	0.00	0.56	1.38	51	25.29
1.97	0.00	7	0.00	0.56	1.38	52	27.33
1.97	0.00	8	0.00	0.56	1.38	53	29.37
1.97	0.00	9	0.00	0.56	1.38	54	30.73
0.56	1.38	10	3.47	0.56	1.38	55	32.08
0.56	1.38	11	6.94	0.56	1.38	56	31.09
0.56	1.38	12	19.95	0.56	1.38	57	30.10
0.56	1.38	13	32.95	0.56	1.38	58	29.61
0.56	1.38	14	34.42	0.56	1.38	59	29.12
0.56	1.38	15	35.88	0.56	1.38	60	28.58
0.56	1.38	16	35.82	0.56	1.38	61	28.05
0.56	1.38	17	35.75	0.56	1.38	62	31.11
0.56	1.38	18	35.69	0.56	1.38	63	34.16
0.56	1.38	19	35.63	0.56	1.38	64	34.14
0.56	1.38	20	34.12	0.56	1.38	65	34.12
0.56	1.38	21	32.62	0.56	1.38	66	34.38
0.56	1.38	22	32.17	0.56	1.38	67	34.64
0.56	1.38	23	31.72	0.56	1.38	68	35.18
0.56	1.38	24	33.70	0.56	1.38	69	35.71
0.56	1.38	25	35.69	1.98	0.45	70	9.26
0.56	1.38	26	34.98	1.98	0.06	71	2.15
0.56	1.38	27	34.27	1.97	0.05	72	1.10
0.56	1.38	28	34.92	1.97	0.03	73	0.67
0.56	1.38	29	35.57	1.97	0.01	74	0.51
0.56	1.38	30	35.51	1.97	0.01	75	0.48
0.56	1.38	31	35.45	1.97	0.00	76	0.38
0.56	1.38	32	34.94	1.97	0.00	77	0.36
0.56	1.38	33	34.44	1.97	0.00	78	0.33
0.56	1.38	34	34.97	1.97	0.00	79	0.31
0.56	1.38	35	35.49	1.97	0.00	80	0.27
0.56	1.38	36	34.92	1.97	0.00	81	0.17
0.56	1.38	37	34.34	1.98	0.00	82	0.13
0.56	1.38	38	34.65	1.97	0.00	83	0.16
0.56	1.38	39	34.96	1.97	0.00	84	0.15
0.56	1.38	40	35.38	1.97	0.00	85	0.12
0.56	1.38	41	35.79	1.98	0.00	86	0.11
0.56	1.38	42	34.92	1.97	0.00	87	0.13
0.56	1.38	43	34.06	1.97	0.00	88	0.11
0.56	1.38	44	34.31	1.97	0.00	89	0.09

Material	Teflon	Temperature	80				
Length	150	Concentration	35				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	0.56	1.38	45	34.04
1.97	0.00	1	0.05	0.56	1.38	46	34.13
1.97	0.00	2	0.05	0.56	1.38	47	34.21
1.97	0.00	3	0.03	0.56	1.38	48	34.70
1.97	0.00	4	0.03	0.56	1.38	49	35.19
1.97	0.00	5	0.03	0.56	1.38	50	35.00
1.97	0.00	6	0.03	0.56	1.38	51	34.81
1.97	0.00	7	0.03	0.56	1.38	52	34.92
1.97	0.00	8	0.03	0.56	1.38	53	35.03
0.56	0.00	9	4.89	0.56	1.38	54	34.67
0.56	1.38	10	18.12	0.56	1.38	55	34.31
0.56	1.38	11	31.35	0.56	1.38	56	34.84
0.56	1.38	12	33.42	0.56	1.38	57	35.36
0.56	1.38	13	35.49	0.56	1.38	58	35.00
0.56	1.38	14	35.17	0.56	1.38	59	34.63
0.56	1.38	15	34.86	0.56	1.38	60	34.69
0.56	1.38	16	34.64	0.56	1.38	61	34.75
0.56	1.38	17	34.41	0.56	1.38	62	32.64
0.56	1.38	18	35.00	0.56	1.38	63	30.53
0.56	1.38	19	35.59	0.56	1.38	64	31.85
0.56	1.38	20	35.73	0.56	1.38	65	33.17
0.56	1.38	21	35.88	0.56	1.38	66	31.95
0.56	1.38	22	35.17	0.56	1.38	67	30.73
0.56	1.38	23	34.46	0.56	1.38	68	16.38
0.56	1.38	24	34.63	1.97	0.06	69	2.02
0.56	1.38	25	34.81	1.97	0.05	70	1.17
0.56	1.38	26	35.15	1.97	0.03	71	0.76
0.56	1.38	27	35.49	1.97	0.01	72	0.57
0.56	1.38	28	35.70	1.97	0.00	73	0.56
0.56	1.38	29	35.92	1.97	0.00	74	0.52
0.56	1.38	30	32.24	1.97	0.00	75	0.47
0.56	1.38	31	28.55	1.97	0.00	76	0.41
0.56	1.38	32	26.63	1.98	0.00	77	0.35
0.56	1.38	33	24.71	1.97	0.00	78	0.31
0.56	1.38	34	28.47	1.98	0.00	79	0.27
0.56	1.38	35	32.22	1.97	0.00	80	0.18
0.56	1.38	36	34.00	1.97	0.00	81	0.17
0.56	1.38	37	35.78	1.97	0.00	82	0.17
0.56	1.38	38	35.46	1.97	0.00	83	0.13
0.56	1.38	39	35.14	1.97	0.00	84	0.14
0.56	1.38	40	34.61	1.97	0.00	85	0.14
0.56	1.38	41	34.09	1.97	0.00	86	0.14
0.56	1.38	42	33.01	1.97	0.00	87	0.14
0.56	1.38	43	31.93	1.97	0.00	88	0.14
0.56	1.38	44	32.98				

Material	Teflon	Temperature	80				
Length	150	Concentration	35				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.02	0.56	1.38	45	35.55
1.97	0.00	1	0.02	0.56	1.38	46	34.69
1.97	0.00	2	0.03	0.56	1.38	47	33.82
1.97	0.00	3	0.03	0.56	1.38	48	33.52
1.97	0.00	4	0.05	0.56	1.38	49	33.22
1.97	0.00	5	0.05	0.56	1.38	50	33.67
1.97	0.00	6	0.05	0.56	1.38	51	34.12
1.97	0.00	7	0.05	0.56	1.38	52	34.52
1.97	0.00	8	0.05	0.56	1.38	53	34.92
1.97	0.00	9	0.05	0.56	1.38	54	35.12
0.56	1.38	10	1.48	0.56	1.38	55	35.33
0.56	1.38	11	2.91	0.56	1.38	56	35.42
0.56	1.38	12	5.79	0.56	1.38	57	35.52
0.56	1.38	13	8.67	0.56	1.38	58	35.19
0.56	1.38	14	21.35	0.56	1.38	59	34.86
0.56	1.38	15	34.02	0.56	1.38	60	34.60
0.56	1.38	16	34.18	0.56	1.38	61	34.34
0.56	1.38	17	34.34	0.56	1.38	62	35.04
0.56	1.38	18	34.34	0.56	1.38	63	35.73
0.56	1.38	19	34.34	0.56	1.38	64	35.64
0.56	1.38	20	33.33	0.56	1.38	65	35.55
0.56	1.38	21	32.33	0.56	1.38	66	34.57
0.56	1.38	22	30.98	0.56	1.38	67	33.59
0.56	1.38	23	29.63	0.56	1.38	68	33.71
0.56	1.38	24	29.24	0.56	1.39	69	33.83
0.56	1.38	25	28.85	1.97	0.06	70	26.63
0.56	1.38	26	28.92	1.97	0.04	71	2.83
0.56	1.38	27	28.99	1.98	0.03	72	1.26
0.56	1.38	28	30.88	1.97	0.01	73	0.94
0.56	1.38	29	32.77	1.98	0.00	74	0.76
0.56	1.38	30	34.17	1.98	0.00	75	0.55
0.56	1.38	31	35.57	1.97	0.00	76	0.35
0.56	1.38	32	35.60	1.97	0.00	77	0.35
0.56	1.38	33	35.63	1.97	0.00	78	0.42
0.56	1.38	34	35.08	1.97	0.00	79	0.38
0.56	1.38	35	34.52	1.97	0.00	80	0.33
0.56	1.38	36	34.96	1.97	0.00	81	0.30
0.56	1.38	37	35.39	1.97	0.00	82	0.25
0.56	1.38	38	34.81	1.97	0.00	83	0.18
0.56	1.38	39	34.23	1.97	0.00	84	0.11
0.56	1.38	40	34.61	1.97	0.00	85	0.14
0.56	1.38	41	34.99	1.97	0.00	86	0.21
0.56	1.38	42	34.65	1.97	0.00	87	0.18
0.56	1.38	43	34.31	1.97	0.00	88	0.14
0.56	1.38	44	34.93	1.97	0.00	89	0.16

Material	Teflon	Temperature	80				
Length	150	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.98	0.03	0	0.18	1.80	0.19	46	3.96
1.98	0.03	1	0.15	1.80	0.19	47	3.94
1.98	0.03	2	0.13	1.80	0.20	48	3.96
1.98	0.03	3	0.12	1.80	0.19	49	3.96
1.98	0.03	4	0.11	1.80	0.19	50	3.96
1.99	0.03	5	0.11	1.81	0.19	51	3.97
2.01	0.03	6	0.10	1.80	0.19	52	3.95
2.00	0.03	7	0.11	1.80	0.19	53	3.96
2.00	0.03	8	0.11	1.80	0.18	54	3.95
2.03	0.03	9	0.11	1.80	0.19	55	4.00
1.80	0.19	10	1.76	1.81	0.19	56	4.01
1.80	0.19	11	3.05	1.80	0.18	57	4.02
1.80	0.19	12	4.34	1.80	0.20	58	4.05
1.80	0.19	13	4.70	1.80	0.18	59	4.04
1.80	0.19	14	5.06	1.80	0.19	60	4.05
1.80	0.19	15	4.92	1.80	0.19	61	4.03
1.80	0.19	16	4.78	1.80	0.18	62	4.06
1.80	0.19	17	4.68	1.80	0.18	63	4.04
1.80	0.19	18	4.58	1.80	0.19	64	4.04
1.80	0.19	19	4.51	1.80	0.19	65	4.05
1.80	0.19	20	4.43	1.80	0.19	66	4.03
1.80	0.19	21	4.39	1.80	0.19	67	4.05
1.80	0.19	22	4.35	1.80	0.18	68	4.05
1.80	0.19	23	4.29	1.80	0.19	69	3.93
1.80	0.19	24	4.23	1.80	0.18	70	2.37
1.80	0.19	25	4.20	2.00	0.05	71	1.51
1.81	0.19	26	4.18	2.00	0.05	72	0.66
1.81	0.19	27	4.13	2.00	0.03	73	0.51
1.80	0.20	28	4.09	2.00	0.03	74	0.37
1.80	0.18	30	4.08	2.00	0.03	75	0.31
1.80	0.19	31	4.03	2.00	0.03	76	0.26
1.80	0.19	32	4.03	2.00	0.03	77	0.24
1.80	0.18	33	3.99	2.00	0.03	78	0.21
1.81	0.19	34	3.99	2.00	0.03	79	0.21
1.80	0.19	35	3.99	2.00	0.03	80	0.21
1.80	0.19	36	3.98	2.00	0.03	81	0.20
1.80	0.19	37	3.98	2.00	0.03	82	0.20
1.80	0.19	38	3.95	2.00	0.03	83	0.18
1.81	0.18	39	3.97	2.00	0.03	84	0.15
1.81	0.18	40	3.95	2.00	0.03	85	0.13
1.80	0.19	41	3.96	2.00	0.03	86	0.10
1.80	0.18	42	3.96	2.00	0.03	87	0.11
1.80	0.18	43	3.95	2.00	0.03	89	0.11
1.80	0.19	44	3.95	2.00	0.03	90	0.11
1.80	0.19	45	3.94	2.00	0.03	91	0.11

Material	Teflon	Temperature	80				
Length	150	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	1	0.11	1.80	0.19	44	4.30
2.00	0.03	2	0.11	1.80	0.18	45	4.32
2.00	0.03	5	0.11	1.80	0.19	47	4.31
2.00	0.03	6	0.11	1.80	0.19	48	4.29
2.00	0.03	7	0.11	1.80	0.19	49	4.29
2.00	0.03	8	0.11	1.80	0.19	50	4.28
2.00	0.03	9	0.11	1.80	0.18	51	4.30
2.00	0.03	10	0.11	1.80	0.20	52	4.27
2.00	0.03	12	0.11	1.80	0.19	54	4.27
2.00	0.03	13	0.17	1.80	0.19	55	4.26
1.80	0.19	13	1.46	1.80	0.19	56	4.27
1.80	0.19	13	2.76	1.80	0.19	57	4.28
1.80	0.19	13	4.23	1.80	0.18	58	4.26
1.80	0.19	13	5.71	1.80	0.19	59	4.28
1.80	0.19	13	5.80	1.80	0.18	61	4.27
1.80	0.19	13	5.89	1.80	0.18	62	4.29
1.80	0.19	13	5.70	1.80	0.19	63	4.29
1.80	0.19	13	5.51	1.80	0.19	64	4.30
1.80	0.19	13	5.38	1.80	0.18	65	4.30
1.80	0.19	13	5.26	1.80	0.18	66	4.29
1.80	0.19	13	5.14	1.80	0.19	68	4.31
1.80	0.19	13	5.03	1.80	0.18	69	4.28
1.80	0.19	13	4.96	1.80	0.19	70	4.30
1.80	0.19	13	4.90	1.80	0.18	71	4.29
1.80	0.19	13	4.84	1.80	0.19	72	3.79
1.80	0.19	13	4.77	2.01	0.04	73	2.01
1.80	0.19	13	4.72	2.00	0.04	73	1.27
1.80	0.19	13	4.67	2.00	0.04	73	0.53
1.80	0.19	13	4.62	2.00	0.04	73	0.43
1.80	0.19	13	4.54	2.00	0.04	73	0.34
1.80	0.19	13	4.54	2.00	0.04	74	0.26
1.80	0.19	28	4.47	2.00	0.03	74	0.21
1.80	0.19	29	4.44	2.00	0.03	74	0.21
1.80	0.19	30	4.42	2.00	0.03	74	0.20
1.80	0.19	31	4.40	2.00	0.03	82	0.15
1.80	0.19	33	4.41	2.00	0.03	83	0.11
1.80	0.20	34	4.37	2.00	0.03	84	0.11
1.80	0.19	35	4.38	2.00	0.03	85	0.11
1.80	0.19	36	4.35	2.00	0.03	86	0.11
1.80	0.18	37	4.36	2.00	0.03	87	0.11
1.80	0.19	38	4.32	2.00	0.03	89	0.11
1.80	0.19	40	4.32	2.00	0.03	90	0.11
1.80	0.20	41	4.33	2.00	0.03	91	0.11
1.80	0.19	42	4.31	2.00	0.03	92	0.19
1.80	0.20	43	4.33	2.00	0.03	93	0.33

Material	Teflon	Temperature	80				
Length	150	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.04	0.03	0	0.09	1.80	0.18	43	4.11
2.04	0.03	1	0.10	1.80	0.18	44	4.11
2.01	0.03	2	0.12	1.80	0.18	46	4.05
1.99	0.03	3	0.12	1.80	0.18	47	4.04
2.01	0.03	4	0.10	1.80	0.18	48	4.04
1.98	0.03	5	0.11	1.80	0.18	49	4.10
1.99	0.03	7	0.11	1.80	0.18	50	4.12
2.02	0.03	8	0.11	1.80	0.18	51	4.12
2.01	0.03	9	0.11	1.80	0.18	52	4.12
2.01	0.03	10	0.11	1.80	0.18	53	4.11
1.80	0.18	11	1.97	1.80	0.18	54	4.12
1.80	0.18	11	3.37	1.80	0.18	55	4.07
1.80	0.18	11	4.77	1.80	0.18	56	4.07
1.80	0.18	11	5.12	1.80	0.18	57	4.08
1.80	0.18	11	5.47	1.80	0.18	59	4.07
1.80	0.18	11	5.32	1.80	0.18	60	4.07
1.80	0.18	11	5.17	1.80	0.18	61	4.10
1.80	0.18	11	5.03	1.80	0.18	62	4.10
1.80	0.18	11	4.90	1.80	0.21	63	4.12
1.80	0.18	11	4.80	1.80	0.21	64	4.12
1.80	0.18	11	4.71	1.80	0.18	65	4.17
1.80	0.18	17	4.57	1.80	0.18	66	4.17
1.80	0.18	18	4.46	1.80	0.18	67	4.16
1.81	0.18	20	4.42	1.80	0.18	68	4.10
1.81	0.18	21	4.32	1.80	0.18	69	4.11
1.80	0.18	22	4.26	2.00	0.03	69	3.31
1.80	0.18	23	4.20	2.00	0.03	69	2.51
1.80	0.18	24	4.21	2.00	0.03	69	1.56
1.80	0.18	25	4.17	2.00	0.03	69	0.60
1.81	0.18	26	4.17	2.00	0.03	69	0.48
1.80	0.18	27	4.17	2.00	0.03	69	0.36
1.80	0.21	28	4.16	2.00	0.03	69	0.31
1.80	0.18	29	4.10	2.00	0.03	69	0.26
1.80	0.21	30	4.10	2.00	0.03	69	0.24
1.80	0.18	31	4.11	2.00	0.03	70	0.22
1.80	0.18	33	4.06	2.00	0.03	70	0.23
1.80	0.18	34	4.07	2.00	0.03	70	0.23
1.80	0.18	35	4.07	2.00	0.03	70	0.22
1.80	0.18	36	4.07	2.00	0.03	70	0.22
1.80	0.18	37	4.07	2.00	0.03	70	0.19
1.80	0.18	38	4.06	2.00	0.03	70	0.16
1.80	0.18	39	4.06	2.00	0.03	70	0.13
1.80	0.18	40	4.07	2.00	0.03	70	0.10
1.80	0.18	41	4.07	2.00	0.03	70	0.07
1.80	0.18	42	4.11	2.00	0.03	70	0.05

Material	Teflon	Temperature	80				
Length	50	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.21	1.80	0.19	45	4.64
1.99	0.03	1	0.21	1.80	0.19	46	4.63
1.99	0.03	2	0.21	1.80	0.19	47	4.64
1.99	0.03	3	0.21	1.80	0.19	48	4.65
1.99	0.03	4	0.21	1.80	0.19	49	4.64
1.99	0.03	5	0.21	1.80	0.19	50	4.62
1.99	0.03	6	0.22	1.80	0.19	51	4.64
1.99	0.03	7	0.22	1.80	0.19	52	4.65
2.01	0.03	8	0.22	1.80	0.19	53	4.64
2.01	0.03	9	0.22	1.80	0.19	54	4.63
1.80	0.19	10	1.15	1.80	0.19	56	4.62
1.80	0.19	11	2.08	1.80	0.19	57	4.65
1.80	0.19	12	3.49	1.80	0.19	58	4.64
1.80	0.19	13	4.90	1.80	0.19	59	4.66
1.80	0.19	14	5.34	1.80	0.19	60	4.63
1.80	0.19	15	5.78	1.80	0.19	61	4.64
1.80	0.19	16	5.66	1.80	0.18	62	4.63
1.80	0.19	17	5.54	1.80	0.20	63	4.63
1.80	0.19	18	5.41	1.80	0.18	64	4.65
1.80	0.19	19	5.27	1.80	0.18	65	4.64
1.80	0.19	20	5.20	1.80	0.20	66	4.65
1.80	0.19	21	5.13	1.80	0.18	67	4.63
1.80	0.19	22	5.06	1.81	0.18	68	4.66
1.80	0.19	23	5.00	1.80	0.19	69	4.63
1.80	0.19	24	4.96	1.80	0.19	70	4.44
1.80	0.19	25	4.92	1.93	0.16	71	2.87
1.80	0.19	26	4.89	2.00	0.04	72	1.95
1.80	0.19	27	4.86	2.00	0.04	73	1.04
1.80	0.19	28	4.82	2.00	0.03	74	0.92
1.80	0.19	29	4.79	2.00	0.03	75	0.80
1.80	0.19	30	4.78	2.00	0.03	76	0.57
1.80	0.19	31	4.76	2.00	0.03	77	0.53
1.80	0.19	32	4.73	2.00	0.03	78	0.50
1.80	0.19	33	4.69	2.00	0.03	79	0.44
1.80	0.19	34	4.69	2.00	0.03	80	0.42
1.80	0.19	35	4.68	2.00	0.03	81	0.39
1.80	0.19	36	4.67	2.00	0.03	82	0.35
1.80	0.19	37	4.67	2.00	0.03	83	0.34
1.80	0.19	38	4.67	2.00	0.03	84	0.33
1.80	0.19	39	4.66	2.00	0.03	85	0.31
1.80	0.19	40	4.64	2.00	0.03	86	0.31
1.80	0.19	41	4.64	2.00	0.03	87	0.31
1.80	0.19	42	4.63	2.00	0.03	88	0.30
1.80	0.19	43	4.64	2.00	0.03	89	0.28
1.80	0.19	44	4.65	2.00	0.03	90	0.26

Material	Teflon	Temperature	80				
Length	50	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.21	1.80	0.20	45	4.84
2.00	0.03	1	0.21	1.80	0.20	46	4.83
2.00	0.03	2	0.21	1.80	0.20	47	4.82
2.00	0.03	3	0.21	1.80	0.20	48	4.82
2.00	0.03	4	0.21	1.80	0.20	49	4.82
2.00	0.03	5	0.21	1.80	0.18	50	4.83
2.00	0.03	6	0.21	1.80	0.18	51	4.84
2.00	0.03	7	0.21	1.80	0.18	52	4.83
2.00	0.03	8	0.21	1.80	0.18	53	4.82
2.00	0.03	9	0.21	1.80	0.18	54	4.83
1.80	0.20	10	1.07	1.80	0.18	55	4.79
1.80	0.20	11	1.92	1.80	0.19	56	4.81
1.80	0.20	12	3.47	1.80	0.19	57	4.80
1.80	0.20	13	5.01	1.81	0.19	58	4.79
1.80	0.20	14	5.60	1.80	0.19	59	4.80
1.80	0.20	15	6.18	1.80	0.18	60	4.78
1.80	0.20	16	6.03	1.80	0.19	61	4.80
1.80	0.20	17	5.88	1.81	0.18	62	4.80
1.80	0.20	18	5.74	1.80	0.19	63	4.82
1.80	0.20	19	5.61	1.80	0.19	64	4.80
1.80	0.20	20	5.51	1.80	0.19	65	4.78
1.80	0.20	21	5.41	1.80	0.18	66	4.79
1.80	0.20	22	5.34	1.80	0.19	67	4.80
1.80	0.20	23	5.28	1.80	0.18	68	4.84
1.80	0.20	24	5.22	1.80	0.19	69	4.62
1.80	0.20	25	5.15	2.00	0.03	70	3.76
1.80	0.20	26	5.13	2.00	0.03	71	2.89
1.80	0.20	27	5.11	2.00	0.03	72	2.42
1.80	0.20	28	5.06	2.00	0.03	73	1.95
1.80	0.20	29	5.02	2.00	0.03	74	1.01
1.80	0.20	30	5.01	2.00	0.03	75	0.90
1.80	0.20	31	4.99	2.00	0.03	76	0.78
1.80	0.20	32	4.97	2.00	0.03	77	0.55
1.80	0.20	33	4.94	2.00	0.03	78	0.52
1.80	0.20	34	4.92	2.00	0.03	79	0.49
1.80	0.20	35	4.89	2.00	0.03	80	0.43
1.80	0.20	36	4.89	2.00	0.03	81	0.39
1.80	0.20	37	4.88	2.00	0.03	82	0.35
1.80	0.20	38	4.86	2.00	0.03	83	0.33
1.80	0.20	39	4.85	2.00	0.03	84	0.31
1.80	0.20	40	4.85	2.00	0.03	85	0.30
1.80	0.20	41	4.86	2.00	0.03	86	0.28
1.80	0.20	42	4.85	2.00	0.03	87	0.26
1.80	0.20	43	4.84	2.00	0.03	88	0.23
1.80	0.20	44	4.84	2.00	0.03	89	0.23

Material	Teflon	Temperature	80				
Length	50	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.21	1.80	0.19	45	4.95
2.00	0.03	1	0.21	1.80	0.19	46	4.95
2.00	0.03	2	0.21	1.80	0.19	47	4.95
2.00	0.03	3	0.21	1.80	0.19	48	4.94
2.00	0.03	4	0.21	1.80	0.19	49	4.92
2.00	0.03	5	0.21	1.80	0.19	50	4.93
2.00	0.03	6	0.21	1.80	0.19	51	4.94
2.00	0.03	7	0.21	1.80	0.19	52	4.94
2.00	0.03	8	0.21	1.80	0.19	53	4.94
2.00	0.03	9	0.21	1.80	0.18	54	4.93
1.81	0.19	10	1.21	1.80	0.19	55	4.95
1.81	0.19	11	2.20	1.80	0.18	56	4.95
1.81	0.19	12	3.81	1.80	0.19	57	4.98
1.80	0.19	13	5.42	1.80	0.19	58	4.95
1.80	0.19	14	5.93	1.80	0.18	59	4.95
1.80	0.19	15	6.44	1.80	0.19	60	4.95
1.80	0.19	16	6.26	1.80	0.19	61	4.95
1.80	0.19	17	6.08	1.80	0.19	62	4.96
1.80	0.19	18	5.95	1.80	0.19	63	4.93
1.80	0.19	19	5.82	1.80	0.18	64	4.95
1.80	0.19	20	5.71	1.80	0.19	65	4.92
1.80	0.19	21	5.59	1.80	0.19	66	4.93
1.80	0.19	22	5.52	1.80	0.18	67	4.91
1.80	0.19	23	5.45	1.80	0.18	68	4.91
1.80	0.19	24	5.39	1.80	0.18	69	4.79
1.80	0.19	25	5.32	1.93	0.17	70	3.05
1.80	0.19	26	5.28	2.00	0.03	71	2.06
1.80	0.19	27	5.23	2.00	0.03	72	1.07
1.80	0.19	28	5.20	2.00	0.03	73	0.95
1.80	0.19	29	5.18	2.00	0.03	74	0.82
1.80	0.19	30	5.14	2.00	0.03	75	0.57
1.80	0.19	31	5.11	2.00	0.03	76	0.53
1.80	0.19	32	5.10	2.00	0.03	77	0.50
1.80	0.19	33	5.10	2.00	0.03	78	0.44
1.80	0.19	34	5.06	2.00	0.03	79	0.42
1.80	0.19	35	5.03	2.00	0.03	80	0.40
1.80	0.19	36	5.03	2.00	0.03	81	0.36
1.80	0.19	37	5.03	2.00	0.03	82	0.34
1.80	0.19	38	5.03	2.00	0.03	83	0.33
1.80	0.19	39	5.02	2.00	0.03	84	0.31
1.80	0.19	40	5.01	2.00	0.03	86	0.31
1.80	0.19	41	5.00	2.00	0.03	87	0.31
1.80	0.19	42	5.00	2.00	0.03	88	0.30
1.80	0.19	43	5.00	2.00	0.03	89	0.29
1.80	0.19	44	4.98	2.00	0.03	90	0.28

Material	Teflon	Temperature	80				
Length	50	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.98	0.03	0	0.21	1.40	0.59	46	13.29
1.99	0.03	1	0.16	1.40	0.59	47	13.37
1.98	0.03	2	0.11	1.39	0.59	48	13.34
1.98	0.03	3	0.11	1.40	0.59	49	13.42
1.98	0.03	4	0.11	1.40	0.59	50	13.38
1.98	0.03	5	0.11	1.40	0.59	51	13.44
1.98	0.03	6	0.11	1.40	0.59	52	13.44
1.99	0.03	7	0.11	1.40	0.59	53	13.43
1.99	0.03	8	0.11	1.40	0.59	54	13.48
1.99	0.03	9	3.51	1.40	0.59	55	13.41
1.39	0.58	10	10.51	1.40	0.59	56	13.50
1.39	0.58	11	12.31	1.40	0.59	57	13.47
1.39	0.59	12	14.10	1.40	0.59	58	13.53
1.39	0.59	13	14.06	1.40	0.60	59	13.51
1.39	0.59	14	14.01	1.40	0.59	60	13.51
1.39	0.59	15	13.90	1.40	0.59	61	13.56
1.39	0.59	16	13.79	1.40	0.59	62	13.51
1.39	0.59	17	13.75	1.40	0.59	63	13.59
1.39	0.59	18	13.70	1.39	0.59	64	13.54
1.39	0.59	19	13.63	1.40	0.59	65	13.60
1.39	0.59	20	13.57	1.40	0.59	66	13.59
1.39	0.59	21	13.53	1.40	0.59	67	13.58
1.39	0.59	22	13.49	1.40	0.59	68	13.63
1.39	0.59	23	13.47	1.40	0.59	69	12.64
1.39	0.59	24	13.46	1.40	0.59	70	6.45
1.39	0.59	25	13.41	1.99	0.06	71	3.66
1.40	0.59	26	13.36	1.99	0.06	72	0.87
1.40	0.59	27	13.38	1.99	0.06	73	0.70
1.40	0.59	28	13.30	1.99	0.06	74	0.52
1.40	0.59	30	13.34	1.99	0.03	75	0.47
1.40	0.59	31	13.30	1.99	0.03	76	0.42
1.40	0.59	32	13.29	1.99	0.03	77	0.39
1.40	0.59	33	13.31	1.99	0.03	78	0.35
1.40	0.59	34	13.26	1.99	0.03	79	0.33
1.39	0.59	35	13.35	1.99	0.03	80	0.31
1.40	0.58	36	13.30	1.99	0.03	81	0.30
1.39	0.59	37	13.30	1.99	0.03	82	0.29
1.40	0.59	38	13.28	1.99	0.03	83	0.26
1.40	0.59	39	13.29	1.99	0.03	84	0.24
1.40	0.59	40	13.33	1.99	0.03	85	0.22
1.40	0.59	41	13.29	1.99	0.03	86	0.21
1.40	0.59	42	13.36	1.99	0.03	87	0.21
1.39	0.59	43	13.31	1.99	0.03	89	0.21
1.40	0.59	44	13.35	1.99	0.03	90	0.21
1.40	0.58	45	13.32	1.99	0.03	91	0.21

Material	Teflon	Temperature	80				
Length	50	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.11	1.40	0.59	46	14.29
1.99	0.03	1	0.11	1.40	0.58	47	14.24
1.99	0.03	2	0.11	1.40	0.59	48	14.33
1.99	0.03	3	0.11	1.40	0.59	49	14.28
1.99	0.03	4	0.11	1.39	0.59	50	14.33
1.99	0.03	5	0.11	1.40	0.59	51	14.30
1.99	0.03	6	0.11	1.40	0.59	52	14.30
1.99	0.03	7	0.11	1.39	0.59	53	14.34
1.99	0.03	8	0.11	1.39	0.59	54	14.30
1.99	0.03	9	2.00	1.40	0.59	55	14.38
1.40	0.59	10	9.73	1.40	0.59	56	14.32
1.40	0.59	11	12.65	1.40	0.58	57	14.36
1.40	0.59	12	15.58	1.40	0.59	58	14.32
1.40	0.59	13	15.47	1.40	0.59	59	14.32
1.40	0.59	14	15.35	1.40	0.60	60	14.39
1.40	0.59	15	15.27	1.40	0.59	61	14.35
1.40	0.59	16	15.18	1.40	0.59	62	14.44
1.40	0.59	17	15.08	1.40	0.59	63	14.39
1.40	0.59	18	14.98	1.40	0.59	64	14.44
1.40	0.59	19	14.90	1.40	0.59	65	14.42
1.40	0.59	20	14.81	1.40	0.59	66	14.43
1.40	0.59	21	14.78	1.40	0.59	67	14.48
1.40	0.59	22	14.75	1.40	0.59	68	14.42
1.40	0.59	23	14.67	1.40	0.59	69	13.02
1.40	0.59	24	14.60	1.39	0.59	70	6.49
1.40	0.59	26	14.59	1.99	0.08	71	3.77
1.40	0.59	27	14.59	1.99	0.08	72	1.04
1.40	0.59	28	14.47	1.99	0.03	73	0.92
1.40	0.59	29	14.44	1.99	0.03	74	0.80
1.39	0.59	30	14.37	1.99	0.03	75	0.57
1.40	0.59	31	14.33	1.99	0.03	77	0.54
1.40	0.59	32	14.34	1.99	0.03	78	0.51
1.39	0.59	33	14.23	1.99	0.03	79	0.44
1.40	0.59	34	14.30	1.99	0.03	80	0.42
1.40	0.59	35	14.24	1.99	0.03	81	0.40
1.40	0.59	36	14.27	1.99	0.03	82	0.36
1.40	0.59	37	14.26	1.99	0.03	83	0.33
1.40	0.59	38	14.25	1.99	0.03	84	0.31
1.40	0.59	39	14.27	1.99	0.03	85	0.31
1.39	0.59	40	14.21	1.99	0.03	86	0.31
1.39	0.59	41	14.28	1.99	0.03	87	0.30
1.40	0.59	42	14.23	1.99	0.03	88	0.28
1.40	0.59	43	14.26	1.99	0.03	89	0.26
1.40	0.59	44	14.24	1.99	0.03	90	0.23
1.40	0.59	45	14.25				

Material	Teflon	Temperature	80				
Length	50	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.27	1.39	0.59	45	14.89
2.00	0.03	1	0.24	1.40	0.59	46	14.96
2.00	0.03	2	0.22	1.40	0.58	47	14.90
2.00	0.03	3	0.22	1.40	0.59	48	14.98
1.99	0.03	4	0.21	1.40	0.59	49	14.97
1.99	0.03	5	0.21	1.40	0.58	50	14.95
1.99	0.03	6	0.21	1.40	0.59	51	15.00
1.99	0.03	7	0.21	1.40	0.59	52	14.96
1.99	0.03	8	0.18	1.40	0.59	53	15.05
1.99	0.03	9	2.47	1.40	0.59	54	14.98
1.39	0.59	10	10.23	1.40	0.59	55	15.04
1.39	0.59	11	12.91	1.40	0.59	56	15.03
1.39	0.59	12	15.59	1.40	0.59	57	15.04
1.39	0.59	13	15.60	1.40	0.59	58	15.10
1.39	0.59	14	15.60	1.40	0.59	59	15.06
1.39	0.59	15	15.52	1.40	0.59	60	15.15
1.39	0.59	16	15.43	1.40	0.59	61	15.09
1.39	0.59	17	15.36	1.40	0.59	62	15.14
1.39	0.59	18	15.28	1.39	0.59	63	15.11
1.39	0.59	19	15.25	1.40	0.59	64	15.10
1.39	0.59	20	15.22	1.40	0.59	65	15.13
1.39	0.59	21	15.15	1.40	0.59	66	15.08
1.39	0.59	22	15.08	1.40	0.59	67	15.15
1.39	0.59	23	15.09	1.40	0.59	68	13.46
1.39	0.59	24	15.09	1.40	0.60	69	6.60
1.39	0.59	25	15.03	1.99	0.03	70	3.81
1.40	0.59	26	14.96	1.99	0.03	71	1.03
1.40	0.59	27	14.98	1.99	0.03	72	0.91
1.40	0.59	28	14.94	1.99	0.03	73	0.80
1.40	0.59	29	14.89	1.99	0.03	74	0.56
1.40	0.59	30	14.92	1.99	0.03	75	0.53
1.40	0.59	31	14.85	1.99	0.03	76	0.51
1.40	0.59	32	14.93	1.99	0.03	77	0.45
1.40	0.59	33	14.86	1.99	0.03	78	0.43
1.40	0.59	34	14.90	1.99	0.03	79	0.42
1.40	0.59	35	14.88	1.99	0.03	80	0.38
1.40	0.59	36	14.88	1.99	0.03	81	0.37
1.39	0.59	37	14.96	1.99	0.03	82	0.36
1.40	0.59	38	14.88	1.99	0.03	83	0.33
1.40	0.59	39	14.92	1.99	0.03	84	0.33
1.40	0.59	40	14.86	1.99	0.03	85	0.32
1.40	0.59	41	14.90	1.99	0.03	86	0.31
1.40	0.59	42	14.88	1.99	0.03	87	0.31
1.40	0.59	43	14.88	1.99	0.03	88	0.31
1.39	0.59	44	14.94	1.99	0.03	89	0.31

Material	Teflon	Temperature	80				
Length	150	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.39	1.40	0.60	47	12.34
2.00	0.03	1	0.39	1.40	0.60	48	12.36
2.00	0.03	2	0.35	1.40	0.60	49	12.35
2.00	0.03	3	0.31	1.40	0.60	50	12.35
2.00	0.03	4	0.29	1.40	0.60	51	12.36
1.98	0.03	5	0.26	1.40	0.60	52	12.37
1.98	0.03	6	1.92	1.40	0.60	53	12.40
1.98	0.03	7	2.75	1.40	0.60	54	12.42
1.98	0.03	8	3.59	1.40	0.60	55	12.42
1.98	0.03	9	6.10	1.40	0.59	56	12.41
1.38	0.58	10	8.61	1.39	0.59	57	12.48
1.38	0.58	11	9.48	1.39	0.59	58	12.45
1.40	0.58	12	10.35	1.40	0.59	59	12.52
1.40	0.58	13	11.39	1.39	0.59	60	12.50
1.40	0.58	14	12.43	1.39	0.59	61	12.53
1.40	0.58	16	12.37	1.40	0.59	62	12.60
1.40	0.59	17	12.31	1.39	0.59	63	12.59
1.40	0.59	18	12.33	1.39	0.59	64	12.65
1.40	0.59	19	12.35	1.39	0.59	65	12.60
1.40	0.59	20	12.34	1.39	0.59	66	12.68
1.40	0.59	21	12.33	1.40	0.59	67	12.67
1.40	0.59	22	12.29	1.39	0.59	68	12.66
1.40	0.59	23	12.25	1.39	0.59	69	12.69
1.40	0.59	24	12.25	1.40	0.59	70	12.70
1.40	0.59	25	12.25	1.40	0.59	71	10.22
1.40	0.59	26	12.23	1.99	0.07	72	7.94
1.40	0.59	27	12.22	1.99	0.07	73	5.67
1.40	0.59	28	12.25	1.99	0.07	74	3.48
1.40	0.59	29	12.27	1.99	0.07	75	1.30
1.40	0.59	30	12.25	1.99	0.07	77	1.17
1.40	0.60	31	12.22	1.99	0.07	78	1.04
1.40	0.60	32	12.23	1.99	0.05	79	0.79
1.40	0.60	33	12.24	1.99	0.05	80	0.75
1.40	0.60	34	12.23	1.99	0.05	81	0.71
1.40	0.60	35	12.22	1.99	0.04	82	0.64
1.40	0.60	36	12.23	1.99	0.04	83	0.59
1.40	0.60	37	12.24	1.99	0.03	84	0.55
1.40	0.60	38	12.27	1.99	0.03	85	0.54
1.40	0.60	39	12.30	1.99	0.03	86	0.52
1.40	0.60	40	12.29	1.99	0.03	87	0.49
1.40	0.60	41	12.28	1.99	0.03	88	0.46
1.40	0.60	42	12.30	1.99	0.03	89	0.44
1.40	0.60	43	12.33	1.99	0.03	90	0.42
1.40	0.60	44	12.32	1.99	0.03	91	0.41
1.40	0.60	45	12.31	1.99	0.03	92	0.41

Material	Teflon	Temperature	80				
Length	150	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.31	1.40	0.59	45	13.32
1.99	0.03	1	0.32	1.40	0.59	46	13.28
1.99	0.03	2	0.31	1.40	0.59	47	13.31
1.99	0.03	3	0.30	1.40	0.59	48	13.34
1.99	0.03	4	0.31	1.40	0.59	49	13.33
1.99	0.03	5	0.31	1.40	0.59	50	13.32
1.99	0.03	6	0.31	1.40	0.59	51	13.34
1.99	0.03	7	0.31	1.40	0.59	52	13.36
1.99	0.03	8	0.31	1.40	0.59	53	13.36
1.99	0.03	9	0.31	1.39	0.59	54	13.35
1.39	0.59	10	6.30	1.40	0.59	55	13.34
1.39	0.59	11	9.11	1.40	0.59	56	13.39
1.39	0.59	12	11.91	1.40	0.59	57	13.35
1.39	0.59	13	12.88	1.40	0.59	58	13.42
1.40	0.59	14	13.84	1.39	0.59	59	13.38
1.40	0.59	15	13.79	1.40	0.59	60	13.43
1.40	0.59	16	13.75	1.40	0.59	61	13.41
1.40	0.59	17	13.67	1.39	0.59	62	13.41
1.40	0.59	18	13.59	1.40	0.59	63	13.46
1.40	0.59	19	13.57	1.40	0.59	64	13.41
1.40	0.59	20	13.55	1.40	0.59	65	13.49
1.40	0.59	21	13.49	1.40	0.59	66	13.45
1.40	0.59	22	13.43	1.40	0.59	67	13.50
1.40	0.59	23	13.43	1.40	0.59	68	13.50
1.40	0.59	24	13.43	1.40	0.59	69	12.81
1.40	0.59	25	13.40	1.95	0.03	70	11.81
1.40	0.59	26	13.37	1.95	0.03	71	10.81
1.40	0.59	27	13.35	1.95	0.03	72	9.60
1.40	0.59	28	13.34	1.95	0.03	73	8.39
1.40	0.59	29	13.35	1.99	0.03	74	5.97
1.40	0.59	30	13.37	1.99	0.03	75	4.81
1.40	0.59	31	13.33	1.99	0.03	76	3.65
1.40	0.59	32	13.28	1.99	0.03	77	1.33
1.40	0.59	33	13.31	1.99	0.03	78	1.21
1.40	0.59	34	13.34	1.99	0.03	79	1.09
1.40	0.59	35	13.32	1.99	0.03	80	0.84
1.40	0.59	36	13.29	1.99	0.03	81	0.75
1.40	0.59	37	13.31	1.99	0.03	82	0.66
1.40	0.59	38	13.33	1.99	0.03	83	0.59
1.40	0.59	39	13.33	1.99	0.03	84	0.52
1.40	0.59	40	13.33	1.99	0.03	85	0.49
1.40	0.59	41	13.31	1.99	0.03	86	0.47
1.40	0.59	42	13.30	1.99	0.03	87	0.44
1.40	0.59	43	13.32	1.99	0.03	88	0.42
1.40	0.59	44	13.35	1.99	0.03	89	0.42

Material	Teflon	Temperature	80				
Length	150	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.31	1.40	0.59	45	14.04
1.99	0.03	1	0.31	1.40	0.59	46	14.03
1.99	0.03	2	0.31	1.40	0.59	47	14.03
1.99	0.03	3	0.31	1.40	0.59	48	14.05
1.99	0.03	4	0.31	1.40	0.59	49	14.08
1.99	0.03	5	0.31	1.40	0.59	50	14.05
1.99	0.03	6	0.31	1.40	0.59	51	14.02
1.99	0.03	7	0.31	1.40	0.59	52	14.05
1.99	0.03	8	0.31	1.40	0.59	53	14.09
1.99	0.03	9	0.31	1.40	0.59	54	14.06
1.39	0.59	10	0.31	1.40	0.59	55	14.04
1.39	0.59	11	9.21	1.40	0.59	56	14.05
1.39	0.59	12	12.71	1.40	0.59	57	14.06
1.40	0.59	13	14.46	1.40	0.59	58	14.06
1.39	0.59	14	14.36	1.40	0.59	59	14.06
1.40	0.59	15	14.24	1.40	0.59	60	14.06
1.40	0.59	16	14.22	1.40	0.59	61	14.07
1.40	0.59	17	14.11	1.40	0.59	62	14.09
1.40	0.59	18	14.13	1.40	0.59	63	14.11
1.40	0.59	19	14.06	1.40	0.59	64	14.09
1.40	0.59	20	14.06	1.40	0.59	65	14.07
1.40	0.59	21	14.05	1.40	0.59	66	14.10
1.40	0.59	22	14.01	1.40	0.59	67	14.14
1.40	0.59	23	14.08	1.40	0.59	68	12.58
1.40	0.59	24	14.02	1.40	0.59	69	11.03
1.40	0.59	25	14.09	1.98	0.16	70	5.83
1.40	0.59	26	14.07	1.99	0.08	71	3.60
1.40	0.59	27	14.04	1.99	0.08	72	1.36
1.40	0.59	28	14.05	1.99	0.08	73	1.24
1.40	0.59	29	14.05	1.99	0.08	74	1.11
1.40	0.59	30	14.05	1.99	0.06	75	0.86
1.40	0.59	31	14.04	1.99	0.06	76	0.82
1.40	0.59	32	14.03	1.99	0.06	77	0.78
1.40	0.59	33	14.02	2.00	0.04	78	0.69
1.40	0.59	34	14.04	2.00	0.04	79	0.66
1.40	0.59	35	14.06	2.00	0.04	80	0.64
1.40	0.59	36	14.04	2.00	0.03	81	0.59
1.40	0.59	37	14.01	2.00	0.03	82	0.57
1.40	0.59	38	14.04	2.00	0.03	83	0.56
1.40	0.59	39	14.07	2.00	0.03	84	0.53
1.40	0.59	40	14.04	2.00	0.03	85	0.52
1.40	0.59	41	14.01	2.00	0.03	86	0.50
1.40	0.59	42	14.03	2.00	0.03	87	0.48
1.40	0.59	43	14.04	2.00	0.03	88	0.45
1.40	0.59	44	14.04	2.00	0.03	89	0.43

Material	Teflon	Temperature	100				
Length	150	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.31	1.80	0.19	45	3.47
2.00	0.03	1	0.25	1.80	0.19	46	3.49
2.00	0.03	2	0.25	1.80	0.19	47	3.52
2.00	0.03	3	0.25	1.80	0.19	48	3.51
2.00	0.03	4	0.25	1.80	0.19	49	3.51
2.00	0.03	5	0.23	1.80	0.19	50	3.51
2.00	0.03	6	0.21	1.80	0.19	51	3.51
2.00	0.03	7	0.21	1.80	0.19	52	3.51
2.00	0.03	8	0.21	1.80	0.19	53	3.51
2.00	0.03	9	1.16	1.80	0.19	54	3.51
1.80	0.03	10	2.12	1.80	0.19	55	3.51
1.78	0.19	11	4.22	1.80	0.19	56	3.52
1.79	0.19	12	4.28	1.80	0.19	57	3.49
1.79	0.19	13	4.35	1.80	0.19	58	3.52
1.79	0.19	14	4.27	1.80	0.19	59	3.51
1.79	0.19	15	4.18	1.80	0.18	60	3.52
1.79	0.19	16	4.08	1.81	0.18	61	3.52
1.80	0.19	17	3.99	1.81	0.19	62	3.51
1.80	0.19	18	3.94	1.80	0.19	63	3.54
1.80	0.19	19	3.88	1.80	0.19	64	3.53
1.80	0.19	20	3.83	1.80	0.18	65	3.55
1.80	0.19	21	3.77	1.80	0.19	66	3.55
1.80	0.19	22	3.73	1.80	0.18	67	3.56
1.80	0.19	23	3.69	1.81	0.19	68	3.56
1.80	0.19	24	3.68	1.81	0.19	69	3.49
1.80	0.19	25	3.66	1.95	0.15	70	2.28
1.80	0.19	26	3.64	2.00	0.05	71	1.55
1.80	0.19	27	3.61	2.00	0.05	72	1.19
1.80	0.19	28	3.60	2.00	0.05	73	0.83
1.80	0.19	29	3.58	2.00	0.05	74	0.66
1.80	0.19	30	3.57	2.00	0.05	75	0.57
1.80	0.19	31	3.55	2.00	0.05	76	0.49
1.80	0.19	32	3.56	2.00	0.05	77	0.43
1.80	0.19	33	3.56	2.00	0.05	78	0.40
1.80	0.19	34	3.55	2.00	0.04	79	0.37
1.80	0.19	35	3.53	2.00	0.04	80	0.35
1.80	0.19	36	3.54	2.00	0.04	81	0.34
1.80	0.19	37	3.54	2.00	0.03	82	0.32
1.80	0.19	38	3.53	2.00	0.03	83	0.32
1.80	0.19	39	3.53	2.00	0.03	84	0.31
1.80	0.19	40	3.52	2.00	0.03	85	0.30
1.80	0.19	41	3.50	2.00	0.03	86	0.30
1.80	0.19	42	3.51	2.00	0.03	87	0.30
1.80	0.19	43	3.51	2.00	0.03	88	0.28
1.80	0.19	44	3.49	2.00	0.03	89	0.25

Material	Teflon	Temperature	100				
Length	150	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.21	1.80	0.19	45	3.80
2.00	0.03	1	0.21	1.80	0.19	46	3.79
2.00	0.03	2	0.21	1.80	0.19	47	3.78
2.00	0.03	3	0.21	1.80	0.19	48	3.79
2.00	0.03	4	0.21	1.80	0.19	49	3.79
2.00	0.03	5	0.21	1.80	0.19	50	3.77
2.00	0.03	6	0.21	1.80	0.19	51	3.76
2.00	0.03	7	0.21	1.80	0.19	52	3.77
2.00	0.03	8	0.21	1.80	0.19	53	3.77
2.00	0.03	9	0.21	1.80	0.19	54	3.77
1.80	0.03	10	1.94	1.80	0.19	55	3.76
1.80	0.19	11	4.36	1.80	0.19	56	3.76
1.80	0.19	12	4.61	1.80	0.18	57	3.77
1.80	0.19	13	4.86	1.80	0.19	58	3.75
1.80	0.19	14	4.73	1.80	0.19	59	3.79
1.80	0.19	15	4.60	1.80	0.19	60	3.78
1.80	0.19	16	4.51	1.81	0.18	61	3.78
1.80	0.19	17	4.41	1.80	0.19	62	3.77
1.80	0.19	18	4.32	1.80	0.19	63	3.77
1.80	0.19	19	4.23	1.80	0.19	64	3.77
1.80	0.19	20	4.19	1.80	0.19	65	3.76
1.80	0.19	21	4.14	1.80	0.20	66	3.78
1.80	0.19	22	4.09	1.80	0.19	67	3.76
1.80	0.19	23	4.04	1.80	0.19	68	3.78
1.80	0.19	24	4.01	1.80	0.19	69	3.69
1.80	0.19	25	3.99	2.00	0.03	70	3.02
1.80	0.19	26	3.97	2.00	0.03	71	2.35
1.80	0.19	27	3.94	2.00	0.03	72	1.60
1.80	0.19	28	3.92	2.00	0.03	73	1.22
1.80	0.19	29	3.89	2.00	0.03	74	0.84
1.80	0.19	30	3.88	2.00	0.03	75	0.66
1.80	0.19	31	3.87	2.00	0.03	76	0.57
1.80	0.19	32	3.86	2.00	0.03	77	0.48
1.80	0.19	33	3.84	2.00	0.03	78	0.42
1.80	0.19	34	3.85	2.00	0.03	79	0.39
1.80	0.19	35	3.86	2.00	0.03	80	0.36
1.80	0.19	36	3.84	2.00	0.03	81	0.33
1.80	0.19	37	3.82	2.00	0.03	82	0.32
1.80	0.19	38	3.82	2.00	0.03	83	0.31
1.80	0.19	39	3.82	2.00	0.03	84	0.30
1.80	0.19	40	3.82	2.00	0.03	85	0.30
1.80	0.19	41	3.81	2.00	0.03	86	0.28
1.80	0.19	42	3.80	2.00	0.03	87	0.26
1.80	0.19	43	3.80	2.00	0.03	88	0.23
1.80	0.19	44	3.80	2.00	0.03	89	0.21

Material	Teflon	Temperature	100				
Length	150	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.03	0	0.21	1.80	0.20	45	3.94
2.00	0.03	1	0.21	1.80	0.20	46	3.94
2.00	0.03	2	0.21	1.80	0.20	47	3.94
2.00	0.03	3	0.21	1.80	0.20	48	3.94
2.00	0.03	4	0.21	1.80	0.20	49	3.94
2.00	0.03	5	0.21	1.80	0.20	50	3.93
2.00	0.03	6	0.21	1.80	0.20	51	3.94
2.00	0.03	7	0.20	1.80	0.20	52	3.96
2.00	0.03	8	0.20	1.80	0.20	53	3.95
2.00	0.03	9	0.20	1.80	0.19	54	3.94
1.80	0.19	10	1.16	1.80	0.19	55	3.94
1.80	0.19	11	2.12	1.80	0.18	56	3.92
1.80	0.19	12	3.40	1.80	0.19	57	3.93
1.80	0.19	13	4.68	1.80	0.19	58	3.91
1.80	0.19	14	4.95	1.80	0.19	59	3.90
1.80	0.19	15	5.21	1.80	0.19	60	3.91
1.80	0.19	16	5.05	1.80	0.18	61	3.89
1.80	0.20	17	4.89	1.80	0.19	62	3.91
1.80	0.20	18	4.77	1.80	0.19	63	3.90
1.80	0.20	19	4.65	1.80	0.19	64	3.92
1.80	0.20	20	4.57	1.81	0.18	65	3.94
1.80	0.20	21	4.48	1.80	0.19	66	3.94
1.80	0.20	22	4.41	1.80	0.19	67	3.96
1.80	0.20	23	4.34	1.80	0.19	68	3.95
1.80	0.20	24	4.30	1.80	0.19	69	3.87
1.80	0.20	25	4.26	1.95	0.15	70	2.50
1.80	0.20	26	4.21	2.00	0.06	71	0.90
1.80	0.20	27	4.16	2.00	0.03	72	0.69
1.80	0.20	28	4.15	2.00	0.03	73	0.49
1.80	0.20	29	4.14	2.00	0.03	74	0.44
1.80	0.20	30	4.11	2.00	0.03	75	0.38
1.80	0.20	31	4.08	2.00	0.03	76	0.36
1.80	0.20	32	4.06	2.00	0.03	77	0.33
1.80	0.20	33	4.04	2.00	0.03	78	0.31
1.80	0.20	34	4.03	2.00	0.03	79	0.29
1.80	0.20	35	4.02	2.00	0.03	80	0.26
1.80	0.20	36	4.00	2.00	0.03	81	0.24
1.80	0.20	37	3.98	2.00	0.03	82	0.22
1.80	0.20	38	3.98	2.00	0.03	83	0.21
1.80	0.20	39	3.99	2.00	0.03	84	0.21
1.80	0.20	40	3.95	2.00	0.03	85	0.21
1.80	0.20	41	3.96	2.00	0.03	86	0.21
1.80	0.20	42	3.96	2.00	0.03	87	0.21
1.80	0.20	43	3.95	2.00	0.03	88	0.21
1.80	0.20	44	3.94	2.00	0.03	89	0.21

Material	Teflon	Temperature	100				
Length	50	Concentration	5				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.01	0.04	0	0.26	1.80	0.19	46	4.66
2.01	0.03	1	0.23	1.80	0.20	47	4.61
2.01	0.03	2	0.22	1.80	0.19	48	4.61
2.01	0.03	3	0.21	1.80	0.19	49	4.66
2.00	0.03	4	0.20	1.81	0.18	50	4.65
2.00	0.03	5	0.15	1.80	0.20	51	4.65
2.01	0.03	6	0.11	1.80	0.19	52	4.66
2.00	0.03	7	0.11	1.80	0.18	53	4.65
2.00	0.03	8	0.11	1.81	0.19	54	4.65
2.01	0.03	9	0.11	1.80	0.18	55	4.66
1.80	0.03	10	2.30	1.80	0.18	56	4.67
1.80	0.19	11	5.41	1.80	0.20	57	4.70
1.80	0.19	12	6.22	1.80	0.19	58	4.70
1.80	0.19	13	6.07	1.81	0.18	59	4.71
1.80	0.19	14	5.92	1.80	0.19	60	4.66
1.80	0.19	15	5.62	1.80	0.19	61	4.66
1.80	0.19	16	5.41	1.80	0.19	62	4.67
1.80	0.19	17	5.34	1.80	0.19	63	4.72
1.80	0.19	18	5.26	1.80	0.19	64	4.71
1.80	0.19	19	5.21	1.80	0.19	65	4.70
1.80	0.19	20	5.16	1.80	0.19	66	4.71
1.80	0.19	21	5.01	1.80	0.18	67	4.71
1.80	0.19	22	4.96	1.80	0.19	68	4.71
1.80	0.19	23	4.91	1.80	0.19	69	4.70
1.80	0.19	24	4.89	1.80	0.19	70	4.70
1.80	0.19	25	4.86	2.00	0.07	71	2.86
1.80	0.19	26	4.86	2.00	0.05	72	0.75
1.80	0.19	27	4.81	2.00	0.04	73	0.35
1.80	0.19	28	4.77	2.00	0.03	74	0.27
1.81	0.19	29	4.72	2.00	0.03	75	0.21
1.80	0.18	31	4.73	2.00	0.03	76	0.21
1.80	0.19	32	4.72	2.00	0.03	77	0.22
1.80	0.19	33	4.71	2.00	0.03	78	0.21
1.81	0.18	34	4.72	2.00	0.03	79	0.17
1.80	0.19	35	4.67	2.00	0.03	80	0.11
1.80	0.20	36	4.66	2.00	0.03	81	0.11
1.80	0.19	37	4.66	2.00	0.03	82	0.11
1.80	0.18	38	4.66	2.00	0.03	83	0.09
1.80	0.19	39	4.66	2.00	0.03	84	0.09
1.80	0.19	40	4.71	2.00	0.03	85	0.10
1.80	0.19	41	4.66	2.00	0.03	86	0.10
1.80	0.18	42	4.66	2.00	0.03	87	0.12
1.80	0.19	43	4.67	2.00	0.03	88	0.12
1.80	0.19	44	4.67	2.00	0.03	90	0.06
1.80	0.19	45	4.66	2.00	0.03	91	0.06

Material	Teflon	Temperature	100				
Length	50	Concentration	5				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.08	0.03	0	0.26	1.80	0.19	46	4.70
2.01	0.03	1	0.21	1.80	0.19	47	4.75
2.00	0.03	2	0.22	1.80	0.19	48	4.72
2.00	0.03	3	0.21	1.80	0.19	49	4.72
2.00	0.03	4	0.21	1.80	0.19	50	4.71
2.01	0.03	5	0.20	1.80	0.18	51	4.76
2.00	0.03	6	0.20	1.80	0.19	52	4.76
2.00	0.03	7	0.16	1.80	0.19	53	4.76
2.00	0.03	8	0.11	1.80	0.18	54	4.76
2.00	0.03	9	0.11	1.80	0.19	55	4.78
1.80	0.20	10	1.36	1.80	0.19	56	4.73
1.80	0.20	11	2.96	1.80	0.19	57	4.73
1.80	0.20	12	4.56	1.80	0.19	58	4.77
1.80	0.20	13	5.41	1.80	0.19	59	4.76
1.80	0.19	14	6.27	1.80	0.18	60	4.76
1.80	0.19	15	6.10	1.80	0.19	61	4.76
1.80	0.19	16	5.93	1.80	0.19	62	4.76
1.80	0.19	17	5.78	1.80	0.18	63	4.76
1.80	0.19	18	5.63	1.80	0.19	64	4.76
1.80	0.19	19	5.55	1.80	0.19	65	4.76
1.80	0.19	20	5.47	1.81	0.19	66	4.81
1.80	0.19	21	5.32	1.80	0.19	67	4.81
1.80	0.19	22	5.17	1.80	0.18	68	4.86
1.80	0.18	23	5.12	1.80	0.19	69	4.86
1.80	0.19	24	5.06	1.80	0.18	70	4.51
1.80	0.19	25	4.96	2.00	0.06	71	3.56
1.80	0.19	26	4.91	2.00	0.06	72	2.61
1.80	0.19	27	4.91	2.00	0.06	73	1.66
1.80	0.18	28	4.86	2.00	0.04	74	0.71
1.80	0.19	29	4.86	2.00	0.04	75	0.53
1.80	0.19	30	4.81	2.00	0.04	76	0.36
1.80	0.18	31	4.82	2.00	0.04	77	0.33
1.80	0.18	32	4.83	2.00	0.03	78	0.30
1.80	0.19	33	4.81	2.00	0.03	79	0.28
1.80	0.18	34	4.76	2.00	0.03	80	0.25
1.80	0.18	36	4.77	2.00	0.03	81	0.23
1.80	0.19	37	4.77	2.00	0.03	82	0.20
1.80	0.19	38	4.76	2.00	0.03	83	0.19
1.80	0.19	39	4.72	2.00	0.03	84	0.22
1.80	0.19	40	4.72	2.00	0.03	85	0.17
1.80	0.19	41	4.77	2.00	0.03	86	0.11
1.80	0.19	42	4.76	2.00	0.03	87	0.12
1.80	0.18	43	4.76	2.00	0.03	88	0.12
1.80	0.18	44	4.77	2.00	0.03	89	0.11
1.80	0.19	45	4.71	2.00	0.03	90	0.06

Material	Teflon	Temperature	100				
Length	50	Concentration	5				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.98	0.03	0	0.25	1.39	0.59	45	4.72
1.98	0.03	1	0.25	1.40	0.59	46	4.73
1.98	0.03	2	0.25	1.40	0.59	47	4.73
1.98	0.03	3	0.25	1.40	0.59	48	4.74
1.98	0.03	4	0.29	1.40	0.59	49	4.74
1.98	0.03	5	0.29	1.40	0.59	50	4.73
1.98	0.03	6	0.29	1.40	0.59	51	4.75
1.98	0.03	7	0.29	1.40	0.59	52	4.76
1.98	0.03	8	0.29	1.40	0.59	53	4.75
1.98	0.03	9	1.79	1.40	0.59	54	4.74
1.38	0.59	10	4.05	1.40	0.59	55	4.76
1.39	0.59	11	4.76	1.40	0.59	56	4.78
1.39	0.59	12	4.75	1.40	0.59	57	4.77
1.39	0.59	13	4.75	1.39	0.59	58	4.77
1.39	0.59	14	4.75	1.40	0.59	59	4.78
1.39	0.59	15	4.73	1.40	0.59	60	4.78
1.39	0.59	16	4.72	1.40	0.59	61	4.82
1.39	0.59	17	4.71	1.40	0.59	62	4.81
1.39	0.59	18	4.70	1.39	0.59	63	4.83
1.39	0.59	19	4.70	1.40	0.59	64	4.82
1.39	0.59	20	4.70	1.40	0.59	65	4.84
1.39	0.59	21	4.69	1.39	0.59	66	4.85
1.39	0.59	22	4.67	1.39	0.59	67	4.83
1.39	0.59	23	4.68	1.40	0.59	68	4.86
1.39	0.59	24	4.69	1.40	0.59	69	4.56
1.39	0.59	25	4.68	1.99	0.08	70	2.51
1.39	0.59	26	4.66	1.99	0.08	71	1.53
1.39	0.59	27	4.67	1.99	0.08	72	0.56
1.39	0.59	28	4.68	1.99	0.08	73	0.45
1.39	0.59	29	4.68	1.99	0.08	74	0.39
1.39	0.59	30	4.67	1.99	0.05	75	0.34
1.39	0.59	31	4.67	1.99	0.05	76	0.30
1.39	0.59	32	4.67	1.99	0.05	77	0.29
1.39	0.59	33	4.68	1.99	0.04	78	0.27
1.39	0.59	34	4.69	1.99	0.04	79	0.25
1.39	0.59	35	4.68	1.99	0.04	80	0.24
1.39	0.59	36	4.68	1.99	0.03	81	0.23
1.39	0.59	37	4.70	1.99	0.03	82	0.21
1.39	0.59	38	4.71	1.99	0.03	83	0.21
1.39	0.59	39	4.71	1.99	0.03	84	0.20
1.39	0.59	40	4.70	1.99	0.03	85	0.19
1.39	0.59	41	4.71	1.99	0.03	86	0.18
1.39	0.59	42	4.72	1.99	0.03	87	0.17
1.39	0.59	43	4.72	1.99	0.03	88	0.16
1.39	0.59	44	4.71	1.99	0.03	89	0.16

Material	Teflon	Temperature	100				
Length	50	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.02	0.04	0	0.37	1.40	0.59	45	13.81
2.02	0.03	1	0.21	1.40	0.59	46	13.75
1.98	0.03	2	0.21	1.40	0.59	47	13.87
1.98	0.03	3	0.16	1.40	0.59	48	13.87
1.99	0.03	4	0.10	1.39	0.59	49	13.87
1.98	0.03	5	0.10	1.39	0.59	50	13.85
2.00	0.03	6	0.11	1.40	0.59	51	13.83
1.99	0.03	7	0.11	1.39	0.59	52	13.88
1.99	0.03	8	0.11	1.39	0.59	53	13.85
1.99	0.03	9	0.45	1.40	0.59	54	13.82
1.39	0.58	10	7.60	1.40	0.59	55	13.87
1.39	0.59	11	14.32	1.40	0.59	56	13.89
1.40	0.59	12	14.23	1.40	0.59	57	13.92
1.40	0.59	13	14.12	1.40	0.59	58	13.92
1.39	0.59	14	13.90	1.40	0.59	59	13.91
1.40	0.59	15	13.91	1.40	0.59	60	13.91
1.39	0.59	16	13.83	1.40	0.59	61	13.91
1.39	0.59	17	13.82	1.39	0.59	62	13.91
1.40	0.59	18	13.78	1.40	0.59	63	13.91
1.40	0.59	19	13.73	1.40	0.60	64	13.96
1.40	0.59	20	13.67	1.39	0.59	65	14.02
1.39	0.59	21	13.66	1.39	0.59	66	13.97
1.40	0.59	22	13.62	1.40	0.59	67	14.07
1.40	0.59	23	13.62	1.40	0.59	68	14.07
1.40	0.59	24	13.67	1.40	0.59	69	14.12
1.40	0.59	25	13.62	2.00	0.09	70	7.76
1.40	0.59	26	13.67	1.99	0.06	71	1.00
1.40	0.59	27	13.68	1.99	0.05	72	0.55
1.40	0.59	28	13.72	1.99	0.03	73	0.51
1.40	0.58	29	13.67	1.99	0.03	74	0.46
1.39	0.59	30	13.72	1.99	0.03	75	0.41
1.40	0.59	31	13.67	1.99	0.03	76	0.36
1.40	0.59	32	13.71	1.99	0.03	77	0.33
1.40	0.59	33	13.71	1.99	0.03	78	0.30
1.40	0.59	34	13.77	1.99	0.03	79	0.30
1.40	0.59	35	13.72	1.99	0.03	80	0.30
1.40	0.59	36	13.71	1.99	0.03	81	0.28
1.40	0.59	37	13.77	1.99	0.03	82	0.26
1.39	0.59	38	13.77	1.99	0.03	83	0.23
1.40	0.59	39	13.71	1.99	0.03	84	0.21
1.40	0.59	40	13.71	1.99	0.03	85	0.21
1.39	0.59	41	13.66	1.99	0.03	86	0.21
1.40	0.59	42	13.67	1.99	0.03	87	0.21
1.40	0.59	43	13.78	1.99	0.03	88	0.21
1.39	0.59	44	13.78	1.99	0.03	89	0.10

Material	Teflon	Temperature	100				
Length	50	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.01	0.03	0	0.32	1.37	0.63	43	12.87
2.01	0.03	1	0.47	1.37	0.63	44	12.87
1.94	0.03	2	0.37	1.36	0.63	45	12.87
1.98	0.03	3	0.31	1.37	0.63	46	12.92
2.00	0.03	4	0.31	1.36	0.63	47	12.97
1.99	0.03	5	0.30	1.37	0.63	48	12.92
1.99	0.03	6	0.25	1.37	0.63	49	13.02
2.00	0.03	7	0.20	1.36	0.63	50	12.97
1.99	0.03	8	0.21	1.36	0.63	51	13.02
2.00	0.03	9	1.31	1.37	0.63	52	13.02
1.36	0.62	10	7.33	1.36	0.63	53	13.02
1.36	0.63	11	9.95	1.37	0.64	54	13.02
1.36	0.63	12	12.58	1.36	0.63	55	13.06
1.36	0.63	13	12.74	1.37	0.63	56	13.01
1.36	0.63	14	12.91	1.36	0.63	57	13.08
1.36	0.63	15	12.87	1.36	0.63	58	13.03
1.36	0.63	16	12.82	1.36	0.63	59	13.01
1.36	0.63	17	12.80	1.36	0.63	60	13.11
1.36	0.63	17	12.77	1.37	0.63	61	13.12
1.36	0.63	18	12.74	1.37	0.64	62	13.17
1.36	0.63	18	12.71	1.36	0.64	63	13.16
1.37	0.63	19	12.71	1.36	0.63	64	13.16
1.36	0.63	20	12.62	1.36	0.63	65	13.12
1.36	0.63	21	12.67	1.37	0.63	66	13.17
1.37	0.63	22	12.61	1.36	0.63	67	13.12
1.36	0.63	23	12.56	2.00	0.08	68	7.86
1.37	0.63	24	12.61	2.00	0.05	69	1.85
1.37	0.63	25	12.61	2.00	0.05	70	1.01
1.36	0.63	26	12.67	2.00	0.03	71	0.82
1.36	0.63	27	12.67	2.00	0.03	72	0.65
1.36	0.63	28	12.62	2.00	0.03	73	0.54
1.36	0.63	29	12.62	2.00	0.03	74	0.51
1.37	0.63	30	12.71	2.00	0.03	75	0.46
1.36	0.63	31	12.66	2.00	0.03	76	0.40
1.36	0.63	32	12.73	2.00	0.03	77	0.40
1.37	0.63	33	12.73	2.00	0.03	78	0.40
1.37	0.63	34	12.77	2.00	0.03	79	0.35
1.36	0.63	35	12.72	2.00	0.03	80	0.30
1.37	0.63	36	12.77	2.00	0.03	81	0.31
1.37	0.63	37	12.76	2.00	0.03	82	0.31
1.36	0.63	38	12.81	2.00	0.03	83	0.31
1.36	0.63	39	12.77	2.00	0.03	84	0.31
1.37	0.63	40	12.82	2.00	0.03	85	0.31
1.37	0.63	41	12.87	2.00	0.03	86	0.30
1.37	0.63	42	12.82	2.00	0.03	87	0.25

Material	Teflon	Temperature	100				
Length	50	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.04	0	0.21	1.40	0.59	45	12.71
2.00	0.03	1	0.21	1.40	0.59	46	12.66
1.99	0.03	2	0.21	1.40	0.59	47	12.67
1.99	0.03	3	0.20	1.40	0.59	48	12.72
1.99	0.03	4	0.20	1.40	0.59	49	12.72
1.99	0.03	5	0.16	1.40	0.59	50	12.78
1.99	0.03	6	0.10	1.40	0.59	51	12.77
1.99	0.03	7	0.10	1.39	0.59	52	12.71
1.99	0.03	8	0.12	1.40	0.59	53	12.72
1.99	0.03	9	0.12	1.40	0.59	54	12.82
1.39	0.58	10	6.32	1.40	0.59	55	12.77
1.39	0.59	11	12.47	1.40	0.59	56	12.82
1.40	0.59	12	12.67	1.40	0.59	57	12.82
1.40	0.59	13	12.67	1.39	0.59	58	12.92
1.40	0.59	14	12.57	1.40	0.59	59	12.91
1.39	0.59	15	12.56	1.40	0.59	60	12.92
1.40	0.59	16	12.46	1.39	0.59	61	12.87
1.39	0.59	17	12.47	1.40	0.59	62	12.91
1.40	0.59	18	12.42	1.39	0.59	63	12.87
1.40	0.59	19	12.47	1.39	0.59	64	12.92
1.40	0.59	20	12.43	1.40	0.59	65	13.02
1.40	0.59	21	12.42	1.40	0.59	66	13.02
1.40	0.59	22	12.42	1.40	0.59	67	13.07
1.40	0.59	23	12.42	1.40	0.59	68	13.06
1.40	0.59	24	12.41	1.39	0.59	69	13.06
1.40	0.59	25	12.46	1.99	0.14	70	8.12
1.40	0.59	26	12.51	1.99	0.05	71	2.26
1.40	0.59	27	12.51	1.99	0.05	72	1.06
1.40	0.59	28	12.51	1.99	0.04	73	0.80
1.40	0.59	29	12.49	1.99	0.03	74	0.66
1.40	0.59	30	12.47	1.99	0.03	75	0.56
1.40	0.59	31	12.48	1.99	0.03	76	0.50
1.40	0.59	32	12.47	1.99	0.03	77	0.46
1.40	0.59	33	12.41	1.99	0.03	78	0.42
1.39	0.59	34	12.46	1.99	0.03	79	0.41
1.39	0.59	35	12.56	1.99	0.03	80	0.35
1.39	0.59	36	12.56	1.99	0.03	81	0.31
1.40	0.59	37	12.61	1.99	0.03	82	0.32
1.39	0.59	38	12.57	1.99	0.03	83	0.31
1.40	0.59	39	12.61	1.99	0.03	84	0.31
1.40	0.59	40	12.61	1.99	0.03	85	0.31
1.39	0.59	41	12.66	1.99	0.03	86	0.31
1.39	0.59	42	12.66	1.99	0.03	87	0.25
1.40	0.59	43	12.72	1.99	0.03	88	0.21
1.40	0.59	44	12.67	1.99	0.03	89	0.21

Material	Teflon	Temperature	100				
Length	150	Concentration	15				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.19	1.40	0.59	45	12.82
1.99	0.03	1	0.17	1.40	0.59	46	12.82
1.99	0.03	2	0.16	1.40	0.59	47	12.81
2.00	0.03	3	0.14	1.40	0.59	48	12.80
2.00	0.03	4	0.13	1.40	0.59	49	12.83
2.00	0.03	5	0.12	1.40	0.59	50	12.87
2.00	0.03	6	0.11	1.40	0.59	51	12.84
2.00	0.03	7	2.04	1.40	0.59	52	12.80
2.00	0.03	8	3.98	1.40	0.59	53	12.84
2.00	0.03	9	5.65	1.40	0.59	54	12.88
2.00	0.03	10	7.33	1.40	0.59	55	12.86
1.39	0.58	11	10.68	1.40	0.59	56	12.84
1.40	0.59	12	13.51	1.40	0.59	57	12.86
1.40	0.59	13	13.42	1.40	0.59	57	12.87
1.40	0.59	14	13.32	1.40	0.59	58	12.87
1.40	0.59	15	13.26	1.40	0.59	59	12.87
1.40	0.59	16	13.21	1.40	0.59	60	12.94
1.40	0.59	17	13.14	1.39	0.59	61	12.87
1.40	0.59	18	13.08	1.40	0.59	62	12.94
1.40	0.59	19	13.03	1.40	0.59	63	12.90
1.40	0.59	20	12.98	1.40	0.59	64	12.95
1.40	0.59	21	12.97	1.40	0.59	65	12.97
1.40	0.59	22	12.97	1.40	0.59	66	12.92
1.40	0.59	23	12.91	1.39	0.59	67	12.98
1.40	0.59	24	12.86	1.40	0.59	68	12.93
1.40	0.59	25	12.87	1.40	0.59	69	12.99
1.40	0.59	26	12.89	1.40	0.59	70	11.28
1.40	0.59	27	12.86	1.99	0.03	71	5.28
1.40	0.59	28	12.82	1.99	0.03	72	3.04
1.40	0.59	29	12.82	1.99	0.03	73	0.80
1.40	0.59	30	12.83	1.99	0.03	74	0.64
1.40	0.59	31	12.82	1.99	0.03	75	0.56
1.40	0.59	32	12.81	1.99	0.03	76	0.48
1.40	0.59	33	12.79	1.99	0.03	77	0.42
1.40	0.59	34	12.76	1.99	0.03	78	0.39
1.40	0.59	35	12.79	1.99	0.03	79	0.36
1.40	0.59	36	12.81	1.99	0.03	80	0.33
1.40	0.59	37	12.78	1.99	0.03	81	0.32
1.40	0.59	38	12.74	1.99	0.03	82	0.31
1.40	0.59	39	12.79	1.99	0.03	83	0.31
1.40	0.59	40	12.83	1.99	0.03	84	0.31
1.40	0.59	41	12.81	1.99	0.03	85	0.31
1.40	0.59	42	12.79	1.99	0.03	86	0.28
1.40	0.59	43	12.80	1.99	0.03	87	0.27
1.40	0.59	44	12.81	1.99	0.03	88	0.26

Material	Teflon	Temperature	100				
Length	150	Concentration	15				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.21	1.40	0.59	45	13.35
1.99	0.03	1	0.21	1.40	0.59	46	13.34
1.99	0.03	2	0.21	1.40	0.59	47	13.34
1.99	0.03	3	0.21	1.40	0.59	48	13.34
1.99	0.03	4	0.21	1.40	0.59	49	13.36
1.99	0.03	5	0.21	1.40	0.59	50	13.38
1.99	0.03	6	0.21	1.40	0.59	51	13.35
1.99	0.03	7	0.21	1.40	0.59	52	13.32
1.99	0.03	8	0.21	1.40	0.59	53	13.36
1.43	0.58	9	3.90	1.40	0.59	54	13.40
1.43	0.58	10	11.00	1.40	0.59	55	13.39
1.40	0.59	11	14.36	1.40	0.59	56	13.37
1.40	0.59	12	14.30	1.40	0.59	57	13.39
1.40	0.59	13	14.23	1.40	0.59	58	13.42
1.40	0.59	14	14.10	1.40	0.59	59	13.39
1.40	0.59	15	13.97	1.40	0.59	60	13.39
1.40	0.59	16	13.84	1.40	0.59	61	13.43
1.40	0.59	17	13.77	1.40	0.59	62	13.39
1.40	0.59	18	13.69	1.39	0.59	63	13.44
1.40	0.59	19	13.65	1.40	0.59	64	13.36
1.40	0.59	20	13.61	1.40	0.59	65	13.42
1.40	0.59	21	13.60	1.39	0.59	66	13.40
1.40	0.59	22	13.58	1.40	0.59	67	13.39
1.40	0.59	23	13.53	1.40	0.59	68	13.43
1.40	0.59	24	13.48	1.39	0.59	69	13.40
1.40	0.59	25	13.49	1.40	0.59	70	11.75
1.40	0.59	26	13.50	1.99	0.47	71	8.67
1.40	0.59	27	13.45	1.99	0.34	72	5.58
1.40	0.59	28	13.39	1.99	0.21	73	3.21
1.40	0.59	29	13.41	1.99	0.08	74	0.84
1.40	0.59	30	13.42	1.99	0.08	75	0.66
1.40	0.59	31	13.40	1.99	0.08	76	0.48
1.40	0.59	32	13.37	1.99	0.08	77	0.43
1.40	0.59	33	13.37	1.99	0.08	78	0.39
1.40	0.59	34	13.36	1.99	0.08	79	0.36
1.40	0.59	35	13.38	1.99	0.08	80	0.34
1.40	0.59	36	13.39	1.99	0.08	81	0.32
1.40	0.59	37	13.36	1.99	0.08	82	0.30
1.40	0.59	38	13.33	1.99	0.08	83	0.30
1.40	0.59	39	13.36	1.99	0.08	84	0.21
1.40	0.59	40	13.40	1.99	0.08	85	0.21
1.40	0.59	41	13.36	1.99	0.08	86	0.21
1.40	0.59	42	13.33	1.99	0.08	87	0.21
1.40	0.59	43	13.34	1.99	0.08	88	0.21
1.40	0.59	44	13.36	1.99	0.08	89	0.21

Material	Teflon	Temperature	100				
Length	150	Concentration	15				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.03	0	0.21	1.40	0.59	45	13.90
1.99	0.03	1	0.21	1.40	0.59	46	13.87
1.99	0.03	2	0.20	1.40	0.59	47	13.84
1.99	0.03	3	0.20	1.40	0.59	48	13.86
1.99	0.03	4	0.19	1.40	0.59	49	13.89
1.99	0.03	5	0.19	1.40	0.59	50	13.87
1.99	0.03	6	0.18	1.40	0.59	51	13.85
1.99	0.03	7	0.18	1.40	0.59	52	13.85
1.99	0.03	8	0.18	1.40	0.59	53	13.85
1.99	0.03	9	0.17	1.40	0.59	54	13.88
1.39	0.03	10	5.74	1.40	0.60	55	13.84
1.39	0.58	11	11.30	1.40	0.59	56	13.90
1.39	0.58	12	12.40	1.39	0.59	57	13.82
1.39	0.58	13	13.50	1.39	0.59	58	13.88
1.39	0.58	14	13.63	1.39	0.59	59	13.86
1.40	0.58	15	13.75	1.40	0.59	60	13.86
1.40	0.58	16	13.78	1.39	0.59	61	13.88
1.40	0.58	17	13.80	1.40	0.59	62	13.84
1.40	0.58	18	13.84	1.40	0.59	63	13.92
1.40	0.58	19	13.87	1.40	0.59	64	13.87
1.40	0.58	20	13.89	1.39	0.59	65	13.92
1.40	0.58	21	13.90	1.40	0.59	66	13.90
1.40	0.58	22	13.91	1.40	0.59	67	13.92
1.40	0.58	23	13.92	1.40	0.59	68	13.94
1.40	0.58	24	13.92	1.40	0.59	69	11.82
1.40	0.58	25	13.92	1.93	0.36	70	5.48
1.40	0.58	26	13.93	1.99	0.03	71	3.16
1.40	0.58	27	13.93	1.99	0.03	72	0.84
1.40	0.58	28	13.93	1.99	0.03	73	0.66
1.40	0.58	29	13.93	1.99	0.03	74	0.57
1.40	0.58	30	13.96	1.99	0.03	75	0.49
1.40	0.59	31	13.98	1.99	0.03	76	0.43
1.40	0.59	32	13.95	1.99	0.03	77	0.41
1.40	0.59	33	13.91	1.99	0.03	78	0.38
1.40	0.59	34	13.91	1.99	0.03	79	0.36
1.40	0.59	35	13.92	1.99	0.03	80	0.34
1.40	0.59	36	13.89	1.99	0.03	81	0.33
1.40	0.59	37	13.87	1.99	0.03	82	0.32
1.40	0.59	38	13.86	1.99	0.03	83	0.31
1.40	0.59	39	13.86	1.99	0.03	84	0.31
1.40	0.59	40	13.88	1.99	0.03	85	0.29
1.40	0.59	41	13.91	1.99	0.03	86	0.29
1.40	0.59	42	13.88	1.99	0.03	87	0.28
1.40	0.59	43	13.85	1.99	0.03	88	0.25
1.40	0.59	44	13.88	1.99	0.03	89	0.23

Material	Teflon	Temperature	100				
Length	50	Concentration	10				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.14	1.58	0.33	45	9.19
1.97	0.00	1	0.14	1.58	0.34	46	9.20
1.97	0.00	2	0.14	1.58	0.34	47	9.19
1.97	0.00	3	0.14	1.58	0.36	48	9.19
1.97	0.00	4	0.14	1.58	0.34	49	9.20
1.97	0.00	5	0.14	1.58	0.34	50	9.21
1.97	0.00	6	0.14	1.58	0.34	51	9.22
1.97	0.00	7	0.06	1.58	0.35	52	9.21
1.97	0.00	8	0.06	1.58	0.34	53	9.21
1.97	0.00	9	0.06	1.58	0.34	54	9.22
1.58	0.34	10	1.64	1.59	0.34	55	9.23
1.58	0.34	11	3.21	1.58	0.35	56	9.23
1.58	0.34	12	6.22	1.58	0.35	57	9.22
1.58	0.34	13	9.23	1.58	0.34	58	9.22
1.58	0.34	14	9.76	1.58	0.33	59	9.23
1.58	0.34	15	10.28	1.58	0.34	60	9.24
1.58	0.34	16	10.17	1.58	0.34	61	9.25
1.58	0.34	17	10.06	1.58	0.34	62	9.24
1.58	0.34	18	9.95	1.58	0.33	63	9.27
1.58	0.34	19	9.84	1.58	0.34	64	9.27
1.58	0.34	20	9.75	1.58	0.33	65	9.28
1.58	0.34	21	9.67	1.58	0.34	66	9.28
1.58	0.34	22	9.61	1.58	0.34	67	9.29
1.58	0.34	23	9.55	1.59	0.34	68	9.30
1.58	0.34	24	9.51	1.58	0.35	69	8.62
1.58	0.34	25	9.48	1.97	0.00	70	6.95
1.58	0.34	26	9.45	1.97	0.00	71	5.27
1.58	0.34	27	9.41	1.97	0.00	72	2.95
1.58	0.34	28	9.39	1.97	0.00	73	0.63
1.58	0.34	29	9.37	1.97	0.00	74	0.46
1.58	0.34	30	9.35	1.97	0.00	75	0.29
1.58	0.34	31	9.33	1.97	0.00	76	0.24
1.58	0.34	32	9.31	1.97	0.00	77	0.19
1.58	0.34	33	9.29	1.97	0.00	78	0.17
1.58	0.34	34	9.28	1.97	0.00	79	0.14
1.58	0.34	35	9.27	1.97	0.00	80	0.13
1.58	0.34	36	9.27	1.97	0.00	81	0.12
1.58	0.34	37	9.27	1.97	0.00	82	0.10
1.58	0.34	38	9.26	1.97	0.00	83	0.07
1.58	0.34	39	9.25	1.97	0.00	84	0.06
1.58	0.34	40	9.24	1.97	0.00	85	0.05
1.58	0.34	41	9.22	1.97	0.00	86	0.05
1.58	0.33	42	9.19	1.97	0.00	87	0.05
1.58	0.34	43	9.19	1.97	0.00	88	0.05
1.58	0.34	44	9.19	1.97	0.00	89	0.05

Material	Teflon	Temperature	100				
Length	50	Concentration	10				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	1.58	0.34	45	9.20
1.97	0.00	1	0.05	1.58	0.35	46	9.19
1.97	0.00	2	0.05	1.58	0.34	47	9.19
1.97	0.00	3	0.05	1.58	0.34	48	9.18
1.97	0.00	4	0.05	1.58	0.34	49	9.17
1.97	0.00	5	0.05	1.58	0.34	50	9.18
1.97	0.00	6	0.05	1.58	0.35	51	9.18
1.97	0.00	7	0.01	1.58	0.34	52	9.18
1.97	0.00	8	0.01	1.58	0.34	53	9.18
1.97	0.00	9	0.01	1.58	0.34	54	9.18
1.58	0.34	10	3.65	1.58	0.34	55	9.18
1.58	0.34	11	4.86	1.58	0.33	56	9.18
1.58	0.34	12	7.28	1.58	0.34	57	9.18
1.58	0.34	13	9.71	1.58	0.34	58	9.19
1.58	0.34	14	10.14	1.58	0.34	59	9.16
1.58	0.34	15	10.57	1.58	0.35	60	9.17
1.58	0.34	16	10.43	1.58	0.34	61	9.17
1.58	0.34	17	10.29	1.58	0.33	62	9.18
1.58	0.34	18	10.16	1.58	0.34	63	9.19
1.58	0.34	19	10.04	1.58	0.34	64	9.22
1.58	0.34	20	9.94	1.59	0.35	65	9.23
1.58	0.34	21	9.85	1.58	0.33	66	9.22
1.58	0.34	22	9.78	1.58	0.34	67	9.21
1.58	0.34	23	9.70	1.58	0.34	68	9.22
1.58	0.34	24	9.65	1.98	0.29	69	8.27
1.58	0.34	25	9.60	1.98	0.00	70	6.50
1.58	0.34	26	9.56	1.98	0.00	71	4.74
1.58	0.34	27	9.53	1.98	0.00	72	2.68
1.58	0.34	28	9.49	1.98	0.00	73	0.62
1.58	0.34	29	9.45	1.98	0.00	74	0.45
1.58	0.34	30	9.42	1.98	0.00	75	0.27
1.58	0.34	31	9.40	1.98	0.00	76	0.23
1.58	0.34	32	9.38	1.98	0.00	77	0.18
1.58	0.34	33	9.36	1.98	0.00	78	0.16
1.58	0.34	34	9.34	1.98	0.00	79	0.14
1.58	0.34	35	9.31	1.98	0.00	80	0.12
1.58	0.34	36	9.29	1.98	0.00	81	0.09
1.58	0.34	37	9.27	1.98	0.00	82	0.07
1.58	0.34	38	9.25	1.98	0.00	83	0.05
1.58	0.34	39	9.23	1.98	0.00	84	0.05
1.58	0.34	40	9.23	1.98	0.00	85	0.05
1.58	0.34	41	9.23	1.98	0.00	86	0.05
1.58	0.35	42	9.21	1.98	0.00	87	0.05
1.58	0.34	43	9.20	1.98	0.00	88	0.05
1.58	0.33	44	9.20				

Material	Teflon	Temperature	100				
Length	50	Concentration	10				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	1.58	0.36	45	9.12
1.97	0.00	1	0.05	1.58	0.36	46	9.09
1.97	0.00	2	0.05	1.58	0.36	47	9.13
1.97	0.00	3	0.05	1.58	0.36	48	9.12
1.97	0.00	4	0.05	1.58	0.36	49	9.12
1.97	0.00	5	0.02	1.58	0.36	50	9.09
1.97	0.00	6	0.02	1.58	0.36	51	9.13
1.97	0.00	7	0.02	1.58	0.36	52	9.12
1.97	0.00	8	0.02	1.58	0.36	53	9.12
1.97	0.00	9	0.02	1.58	0.36	54	9.09
1.58	0.34	10	1.90	1.58	0.36	55	9.09
1.58	0.34	11	3.78	1.58	0.34	56	9.09
1.58	0.34	12	6.68	1.58	0.35	57	9.08
1.58	0.34	13	9.59	1.58	0.34	58	9.07
1.58	0.34	14	10.08	1.58	0.34	59	9.06
1.58	0.34	15	10.58	1.58	0.34	60	9.04
1.58	0.34	16	10.44	1.58	0.35	61	9.03
1.58	0.34	17	10.29	1.58	0.34	62	9.04
1.58	0.34	18	10.14	1.58	0.33	63	9.03
1.58	0.34	19	9.99	1.58	0.34	64	9.04
1.58	0.34	20	9.88	1.58	0.34	65	9.04
1.58	0.34	21	9.77	1.58	0.34	66	9.03
1.58	0.34	22	9.70	1.58	0.34	67	9.03
1.58	0.34	23	9.62	1.58	0.34	68	9.01
1.58	0.34	24	9.56	1.58	0.34	69	9.05
1.58	0.34	25	9.50	1.96	0.06	70	7.50
1.58	0.34	26	9.45	1.96	0.03	71	2.89
1.58	0.34	27	9.41	1.96	0.02	72	0.47
1.58	0.34	28	9.36	1.96	0.00	73	0.36
1.58	0.34	29	9.32	1.96	0.00	74	0.24
1.58	0.34	30	9.29	1.96	0.00	75	0.21
1.58	0.34	31	9.26	1.96	0.00	76	0.17
1.58	0.34	32	9.23	1.96	0.00	77	0.15
1.58	0.34	33	9.21	1.96	0.00	78	0.13
1.58	0.34	34	9.19	1.96	0.00	79	0.11
1.58	0.34	35	9.17	1.96	0.00	80	0.09
1.58	0.34	36	9.16	1.96	0.00	81	0.07
1.58	0.34	37	9.15	1.96	0.00	82	0.05
1.58	0.34	38	9.14	1.96	0.00	83	0.05
1.58	0.34	39	9.13	1.96	0.00	84	0.05
1.58	0.36	40	9.12	1.96	0.00	85	0.05
1.58	0.36	41	9.12	1.96	0.00	86	0.05
1.58	0.36	42	9.09	1.96	0.00	87	0.05
1.58	0.36	43	9.13	1.96	0.00	88	0.05
1.58	0.36	44	9.12	1.96	0.00	89	0.05

Material	Teflon	Temperature	100				
Length	50	Concentration	25				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.07	0.98	0.97	45	24.26
1.97	0.00	1	0.07	0.97	0.97	46	24.31
1.97	0.00	2	0.07	0.98	0.97	47	24.35
1.97	0.00	3	0.05	0.98	0.97	48	24.41
1.97	0.00	4	0.05	0.98	0.97	49	24.41
1.97	0.00	5	0.05	0.98	0.98	50	24.46
1.97	0.00	6	0.05	0.98	0.98	51	24.49
1.97	0.00	7	0.05	0.98	0.98	52	24.57
1.97	0.00	8	0.05	0.98	0.98	53	24.60
1.97	0.00	9	0.05	0.98	0.97	54	24.66
0.98	0.97	10	1.30	0.98	0.98	55	24.68
0.98	0.97	11	2.55	0.98	0.98	56	24.72
0.98	0.97	12	7.52	0.98	0.97	57	24.74
0.98	0.97	13	12.48	0.98	0.97	58	24.81
0.98	0.97	14	17.72	0.97	0.97	59	24.84
0.98	0.97	15	22.96	0.98	0.98	60	24.87
0.98	0.97	16	23.29	0.98	0.97	61	24.90
0.98	0.97	17	23.62	0.98	0.97	62	24.95
0.98	0.97	18	23.64	0.98	0.98	63	24.97
0.98	0.97	19	23.66	0.97	0.97	64	25.02
0.98	0.97	20	23.68	0.98	0.98	65	25.03
0.98	0.97	21	23.69	0.98	0.97	66	25.08
0.98	0.97	22	23.71	0.98	0.97	67	25.10
0.98	0.97	23	23.73	0.98	0.97	68	25.14
0.98	0.97	24	23.74	0.98	0.97	69	25.19
0.98	0.97	25	23.76	1.97	0.00	70	23.67
0.98	0.97	26	23.77	1.97	0.00	71	22.15
0.98	0.97	27	23.77	1.97	0.00	72	15.82
0.98	0.97	28	23.80	1.97	0.00	73	9.48
0.98	0.97	29	23.82	1.97	0.00	74	5.39
0.98	0.97	30	23.82	1.97	0.00	75	1.30
0.98	0.97	31	23.82	1.97	0.00	76	0.97
0.98	0.97	32	23.84	1.97	0.00	77	0.63
0.98	0.97	33	23.86	1.97	0.00	78	0.54
0.98	0.97	34	23.88	1.97	0.00	79	0.45
0.98	0.97	35	23.90	1.97	0.00	80	0.39
0.98	0.97	36	23.92	1.97	0.00	81	0.33
0.98	0.97	37	23.95	1.97	0.00	82	0.29
0.98	0.97	38	23.97	1.97	0.00	83	0.25
0.98	0.97	39	23.99	1.97	0.00	84	0.24
0.98	0.98	40	24.02	1.97	0.00	85	0.22
0.98	0.97	41	24.05	1.97	0.00	86	0.20
0.98	0.97	42	24.13	1.97	0.00	87	0.17
0.98	0.97	43	24.17	1.97	0.00	88	0.16
0.98	0.97	44	24.24	1.97	0.00	89	0.14

Material	Teflon	Temperature	100				
Length	50	Concentration	25				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.12	0.98	0.98	45	24.13
1.97	0.00	1	0.12	0.97	0.97	46	24.17
1.97	0.00	2	0.12	0.98	0.97	47	24.21
1.97	0.00	3	0.08	0.98	0.97	48	24.23
1.97	0.00	4	0.08	0.97	0.97	49	24.25
1.97	0.00	5	0.08	0.98	0.98	50	24.25
1.97	0.00	6	0.08	0.97	0.97	51	24.31
1.97	0.00	7	0.08	0.98	0.98	52	24.31
1.97	0.00	8	0.08	0.98	0.97	53	24.35
1.97	0.00	9	0.08	0.98	0.97	54	24.37
0.98	0.97	10	3.14	0.98	0.97	55	24.45
0.98	0.97	11	6.20	0.98	0.97	56	24.45
0.98	0.97	12	9.26	0.98	0.97	57	24.51
0.98	0.97	13	12.33	0.98	0.98	58	24.52
0.98	0.97	14	17.64	0.98	0.97	59	24.56
0.98	0.97	15	22.96	0.98	0.97	60	24.56
0.98	0.97	16	23.65	0.98	0.98	61	24.59
0.98	0.97	17	24.33	0.98	0.97	62	24.64
0.98	0.97	18	24.31	0.98	0.97	63	24.71
0.98	0.97	19	24.29	0.97	0.97	64	24.72
0.98	0.97	20	24.23	0.98	0.97	65	24.78
0.98	0.97	21	24.18	0.98	0.97	66	24.79
0.98	0.97	22	24.15	0.98	0.97	67	24.82
0.98	0.97	23	24.13	0.98	0.98	68	24.85
0.98	0.97	24	24.10	0.98	0.97	69	24.89
0.98	0.97	25	24.08	1.97	0.00	70	22.93
0.98	0.97	26	24.06	1.97	0.00	71	20.97
0.98	0.97	27	24.05	1.97	0.00	72	15.14
0.98	0.97	28	24.04	1.97	0.00	73	9.32
0.98	0.97	29	24.03	1.97	0.00	74	5.35
0.98	0.97	30	24.03	1.97	0.00	75	1.37
0.98	0.97	31	24.03	1.97	0.00	76	1.02
0.98	0.97	32	24.03	1.97	0.00	77	0.67
0.98	0.97	33	24.02	1.97	0.00	78	0.57
0.98	0.97	34	24.04	1.97	0.00	79	0.48
0.98	0.97	35	24.05	1.97	0.00	80	0.42
0.98	0.97	36	24.05	1.97	0.00	81	0.37
0.98	0.97	37	24.04	1.97	0.00	82	0.33
0.98	0.97	38	24.06	1.97	0.00	83	0.29
0.98	0.97	39	24.08	1.97	0.00	84	0.27
0.98	0.97	40	24.08	1.97	0.00	85	0.24
0.98	0.97	41	24.09	1.97	0.00	86	0.23
0.98	0.97	42	24.09	1.97	0.00	87	0.21
0.98	0.98	43	24.13	1.97	0.00	88	0.19
0.98	0.97	44	24.11	1.97	0.00	89	0.16

Material	Teflon	Temperature	100				
Length	50	Concentration	25				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.14	0.98	0.97	45	24.35
1.97	0.00	1	0.14	0.98	0.97	46	24.37
1.97	0.00	2	0.14	0.97	0.98	47	24.38
1.97	0.00	3	0.14	0.98	0.98	48	24.42
1.97	0.00	4	0.14	0.98	0.97	49	24.42
1.97	0.00	5	0.14	0.98	0.98	50	24.43
1.97	0.00	6	0.14	0.97	0.97	51	24.44
1.97	0.00	7	0.56	0.98	0.97	52	24.49
1.97	0.00	8	0.56	0.98	0.98	53	24.49
1.97	0.00	9	0.56	0.97	0.97	54	24.52
0.98	0.98	10	3.41	0.97	0.97	55	24.56
0.98	0.98	11	6.25	0.98	0.97	56	24.56
0.98	0.98	12	9.10	0.98	0.97	57	24.57
0.98	0.98	13	11.95	0.98	0.97	58	24.59
0.98	0.98	14	17.51	0.98	0.98	59	24.60
0.98	0.98	15	23.08	0.98	0.98	60	24.61
0.98	0.98	16	23.86	0.98	0.98	61	24.65
0.98	0.98	17	24.64	0.97	0.97	62	24.66
0.98	0.98	18	24.59	0.97	0.98	63	24.67
0.98	0.98	19	24.55	0.98	0.97	64	24.67
0.98	0.98	20	24.52	0.98	0.97	65	24.69
0.98	0.98	21	24.49	0.98	0.97	66	24.73
0.98	0.98	22	24.45	0.98	0.98	67	24.75
0.98	0.98	23	24.41	0.98	0.97	68	24.75
0.98	0.98	24	24.40	0.98	0.97	69	24.79
0.98	0.98	25	24.38	1.97	0.00	70	22.87
0.98	0.98	26	24.36	1.97	0.00	71	20.94
0.98	0.98	27	24.35	1.97	0.00	72	18.35
0.98	0.98	28	24.34	1.97	0.00	73	15.76
0.98	0.98	29	24.34	1.97	0.00	74	10.57
0.98	0.98	30	24.33	1.97	0.00	75	6.08
0.98	0.98	31	24.32	1.97	0.00	76	1.59
0.98	0.98	32	24.33	1.97	0.00	77	1.14
0.98	0.98	33	24.34	1.97	0.00	78	0.69
0.98	0.98	34	24.33	1.97	0.00	79	0.59
0.98	0.98	35	24.31	1.97	0.00	80	0.50
0.98	0.98	36	24.32	1.97	0.00	81	0.44
0.98	0.98	37	24.34	1.97	0.00	82	0.39
0.98	0.98	38	24.33	1.97	0.00	83	0.34
0.98	0.98	39	24.32	1.97	0.00	84	0.30
0.98	0.98	40	24.32	1.97	0.00	85	0.28
0.98	0.97	41	24.31	1.97	0.00	86	0.25
0.98	0.98	42	24.35	1.97	0.00	87	0.25
0.98	0.97	43	24.34	1.97	0.00	88	0.24
0.98	0.98	44	24.36	1.97	0.00	89	0.24

Material	Teflon	Temperature	100				
Length	50	Concentration	35				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.14	0.53	1.30	45	34.58
1.97	0.00	1	0.14	0.53	1.30	46	35.33
1.97	0.00	2	0.14	0.53	1.30	47	35.83
1.97	0.00	3	0.14	0.53	1.30	48	34.26
1.97	0.00	4	0.14	0.53	1.30	49	34.75
1.97	0.00	5	0.08	0.53	1.30	50	35.95
1.97	0.00	6	0.08	0.53	1.30	51	35.08
1.97	0.00	7	0.08	0.53	1.30	52	34.56
1.97	0.00	8	0.26	0.53	1.30	53	35.66
1.97	0.00	9	6.54	0.53	1.30	54	34.92
0.53	1.30	10	19.78	0.53	1.30	55	34.78
0.53	1.30	11	33.03	0.53	1.30	56	34.72
0.53	1.30	12	34.02	0.53	1.30	57	35.30
0.53	1.30	13	34.59	0.53	1.30	58	35.58
0.53	1.30	14	34.31	0.53	1.30	59	35.48
0.53	1.30	15	35.98	0.53	1.30	60	34.46
0.53	1.30	16	33.47	0.53	1.30	61	35.13
0.53	1.30	17	31.94	0.53	1.30	62	35.02
0.53	1.30	18	31.73	0.53	1.30	63	35.05
0.53	1.30	19	31.53	0.53	1.30	64	34.05
0.53	1.30	20	32.38	0.53	1.30	65	35.63
0.53	1.30	21	33.24	0.53	1.30	66	34.80
0.53	1.30	22	32.28	0.53	1.30	67	34.61
0.53	1.30	23	31.33	0.53	1.30	68	21.14
0.53	1.30	24	30.04	0.53	1.30	69	7.66
0.53	1.30	25	28.75	2.01	0.12	70	1.39
0.53	1.30	26	31.35	1.96	0.10	71	1.14
0.53	1.30	27	33.96	1.98	0.06	72	0.80
0.53	1.30	28	34.48	1.96	0.02	73	0.53
0.53	1.30	29	35.87	1.97	0.01	74	0.44
0.53	1.30	30	35.00	1.98	0.00	75	0.48
0.53	1.30	31	35.30	1.97	0.00	76	0.41
0.53	1.30	32	35.74	1.97	0.00	77	0.34
0.53	1.30	33	35.40	1.97	0.00	78	0.26
0.53	1.30	34	35.51	1.97	0.00	79	0.21
0.53	1.30	35	34.97	1.97	0.00	80	0.23
0.53	1.30	36	34.30	1.97	0.00	81	0.24
0.53	1.30	37	33.59	1.97	0.00	82	0.18
0.53	1.30	38	34.29	1.97	0.00	83	0.14
0.53	1.30	39	34.98	1.97	0.00	84	0.12
0.53	1.30	40	34.99	1.97	0.00	85	0.11
0.53	1.30	41	34.45	1.97	0.00	86	0.13
0.53	1.30	42	35.39	1.97	0.00	87	0.10
0.53	1.30	43	34.16	1.97	0.00	88	0.11
0.53	1.30	44	36.00	1.97	0.00	89	0.14

Material	Teflon	Temperature	100				
Length	50	Concentration	35				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.05	0.53	1.31	45	35.91
1.97	0.00	1	0.05	0.53	1.31	46	34.18
1.97	0.00	2	0.05	0.53	1.31	47	34.87
1.97	0.00	3	0.05	0.53	1.31	48	34.81
1.97	0.00	4	0.05	0.53	1.30	49	35.71
1.97	0.00	5	0.36	0.53	1.30	50	33.27
1.97	0.00	6	0.36	0.53	1.30	51	31.53
1.97	0.00	7	0.36	0.53	1.30	52	33.27
1.97	0.00	8	0.36	0.53	1.30	53	34.75
0.53	1.30	9	4.17	0.53	1.30	54	34.43
0.53	1.30	10	7.98	0.53	1.30	55	34.53
0.53	1.30	11	32.40	0.53	1.30	56	34.29
0.53	1.30	12	33.00	0.53	1.30	57	35.54
0.53	1.30	13	33.60	0.53	1.30	58	34.95
0.53	1.30	14	34.30	0.53	1.30	59	34.89
0.53	1.30	15	34.88	0.53	1.30	60	33.38
0.53	1.30	16	34.41	0.53	1.30	61	31.86
0.53	1.30	17	35.60	0.53	1.30	62	31.32
0.53	1.30	18	34.57	0.53	1.30	63	30.77
0.53	1.30	19	34.14	0.53	1.30	64	31.00
0.53	1.30	20	34.57	0.53	1.30	65	31.22
0.53	1.30	21	35.73	0.53	1.30	66	32.89
0.53	1.30	22	34.75	0.53	1.30	67	34.56
0.53	1.30	23	35.96	0.53	1.30	68	31.11
0.53	1.30	24	35.65	1.98	0.12	69	27.66
0.53	1.30	25	34.99	1.96	0.10	70	2.43
0.53	1.30	26	34.73	1.97	0.07	71	0.50
0.53	1.30	27	34.46	1.99	0.04	72	0.45
0.53	1.30	28	34.73	1.97	0.01	73	0.49
0.53	1.30	29	34.05	1.98	0.00	74	0.46
0.53	1.30	30	34.74	1.97	0.00	75	0.28
0.53	1.31	31	34.05	1.98	0.00	76	0.29
0.53	1.31	32	35.46	1.97	0.00	77	0.34
0.53	1.31	33	35.80	1.97	0.00	78	0.31
0.53	1.31	34	34.75	1.97	0.00	79	0.26
0.53	1.31	35	34.96	1.97	0.00	80	0.22
0.53	1.31	36	35.96	1.97	0.00	81	0.17
0.53	1.31	37	34.59	1.97	0.00	82	0.18
0.53	1.31	38	35.12	1.97	0.00	83	0.19
0.53	1.31	39	35.97	1.97	0.00	84	0.15
0.53	1.31	40	35.73	1.98	0.00	85	0.14
0.53	1.31	41	34.70	1.97	0.00	86	0.14
0.53	1.31	42	35.98	1.97	0.00	87	0.14
0.53	1.31	43	35.45	1.97	0.00	88	0.09
0.53	1.31	44	34.36			89	

Material	Teflon	Temperature	100				
Length	50	Concentration	35				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.04	0.53	1.30	45	31.71
1.97	0.00	1	0.04	0.53	1.30	46	33.80
1.97	0.00	2	0.04	0.53	1.30	47	35.89
1.97	0.00	3	0.04	0.53	1.30	48	35.25
1.97	0.00	4	0.04	0.53	1.30	49	34.61
1.97	0.00	5	0.04	0.53	1.30	50	35.27
1.97	0.00	6	0.04	0.53	1.30	51	35.93
1.97	0.00	7	0.04	0.53	1.30	52	34.67
1.97	0.00	8	0.05	0.53	1.30	53	33.41
1.97	0.00	9	0.04	0.53	1.30	54	33.78
0.53	1.30	10	2.06	0.53	1.30	55	34.16
0.53	1.30	11	4.08	0.53	1.30	56	35.03
0.53	1.30	12	17.06	0.53	1.30	57	35.91
0.53	1.30	13	30.04	0.53	1.30	58	35.57
0.53	1.30	14	33.01	0.53	1.30	59	35.23
0.53	1.30	15	35.97	0.53	1.30	60	35.06
0.53	1.30	16	34.34	0.53	1.30	61	34.89
0.53	1.30	17	32.72	0.53	1.30	62	35.31
0.53	1.30	18	32.37	0.53	1.30	63	35.74
0.53	1.30	19	32.02	0.53	1.30	64	34.87
0.53	1.30	20	33.57	0.53	1.30	65	34.00
0.53	1.30	21	35.11	0.53	1.30	66	34.31
0.53	1.30	22	35.37	0.53	1.30	67	34.62
0.53	1.30	23	35.64	0.53	1.30	68	34.60
0.53	1.30	24	35.47	0.53	1.30	69	34.58
0.53	1.30	25	35.30	1.98	0.13	70	18.65
0.53	1.30	26	34.81	1.97	0.11	71	2.72
0.53	1.30	27	34.33	1.96	0.06	72	1.05
0.53	1.30	28	34.47	1.98	0.04	73	0.70
0.53	1.30	29	34.62	1.97	0.01	74	0.68
0.53	1.30	30	34.69	1.97	0.00	75	0.58
0.53	1.30	31	34.76	1.97	0.00	76	0.50
0.53	1.30	32	35.24	1.97	0.00	77	0.33
0.53	1.30	33	35.72	1.97	0.00	78	0.27
0.53	1.30	34	34.70	1.97	0.00	79	0.30
0.53	1.30	35	33.68	1.97	0.00	80	0.25
0.53	1.30	36	34.34	1.97	0.00	81	0.22
0.53	1.30	37	35.00	1.97	0.00	82	0.15
0.53	1.30	38	34.75	1.97	0.00	83	0.13
0.53	1.30	39	34.51	2.01	0.00	84	0.14
0.53	1.30	40	32.81	1.97	0.00	85	0.08
0.53	1.30	41	31.11	1.97	0.00	86	0.09
0.53	1.30	42	29.31	1.97	0.00	87	0.14
0.53	1.30	43	27.51	1.97	0.00	88	0.14
0.53	1.30	44	29.61	1.97	0.00	89	0.14

Material	Teflon	Temperature	100				
Length	150	Concentration	10				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.19	1.59	0.34	45	8.82
1.99	0.00	1	0.19	1.58	0.34	46	8.83
1.99	0.00	2	0.20	1.58	0.34	47	8.85
1.99	0.00	3	0.16	1.60	0.34	48	8.85
1.99	0.00	4	0.11	1.58	0.34	49	8.85
1.99	0.00	5	0.09	1.59	0.33	50	8.86
2.00	0.00	6	0.07	1.58	0.34	51	8.88
2.00	0.00	7	0.06	1.58	0.34	52	8.89
2.00	0.00	8	0.05	1.58	0.34	53	8.90
2.00	0.00	9	1.83	1.58	0.34	54	8.92
1.58	0.34	10	3.35	1.59	0.34	55	8.96
1.58	0.34	11	4.87	1.58	0.34	56	8.97
1.58	0.34	12	6.95	1.58	0.36	57	8.97
1.58	0.34	13	9.04	1.59	0.34	58	8.96
1.58	0.34	14	9.04	1.58	0.34	59	8.97
1.58	0.34	15	9.04	1.58	0.35	60	8.99
1.58	0.34	16	9.01	1.59	0.34	61	9.02
1.58	0.34	17	8.98	1.58	0.33	62	9.02
1.58	0.34	18	8.96	1.58	0.34	63	9.02
1.58	0.34	19	8.93	1.58	0.34	64	9.04
1.58	0.34	20	8.91	1.58	0.34	65	9.05
1.58	0.34	21	8.88	1.58	0.34	66	9.05
1.58	0.34	22	8.87	1.58	0.34	67	9.06
1.58	0.34	23	8.85	1.58	0.34	68	8.75
1.58	0.34	24	8.83	1.58	0.33	69	6.35
1.58	0.34	25	8.82	1.97	0.00	70	3.70
1.58	0.34	26	8.81	1.97	0.00	71	1.06
1.58	0.34	27	8.80	1.97	0.00	72	0.79
1.58	0.34	28	8.78	1.97	0.00	73	0.52
1.58	0.34	29	8.77	1.97	0.00	74	0.45
1.58	0.34	30	8.77	1.97	0.00	75	0.38
1.58	0.34	31	8.77	1.97	0.00	76	0.33
1.58	0.34	32	8.77	1.97	0.00	77	0.29
1.58	0.34	33	8.76	1.97	0.00	78	0.26
1.58	0.34	34	8.77	1.97	0.00	79	0.24
1.58	0.34	35	8.78	1.97	0.00	80	0.24
1.58	0.34	36	8.78	1.97	0.00	81	0.24
1.58	0.34	37	8.78	1.97	0.00	82	0.21
1.59	0.34	38	8.78	1.97	0.00	83	0.19
1.59	0.33	39	8.78	1.97	0.00	84	0.16
1.59	0.34	40	8.78	1.97	0.00	85	0.14
1.58	0.35	41	8.79	1.97	0.00	86	0.14
1.59	0.35	42	8.80	1.97	0.00	87	0.14
1.60	0.34	43	8.80	1.97	0.00	88	0.14
1.58	0.33	44	8.79	1.97	0.00	89	0.14

Material	Teflon	Temperature	100				
Length	150	Concentration	10				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.14	1.58	0.34	45	9.07
1.97	0.00	1	0.14	1.58	0.34	46	9.06
1.97	0.00	2	0.14	1.58	0.35	47	9.07
1.97	0.00	3	0.14	1.58	0.34	48	9.08
1.97	0.00	4	0.14	1.58	0.34	49	9.06
1.97	0.00	5	0.14	1.58	0.34	50	9.08
1.97	0.00	6	0.14	1.58	0.34	51	9.09
1.97	0.00	7	0.13	1.58	0.36	52	9.10
1.97	0.00	8	0.13	1.58	0.34	53	9.11
1.97	0.00	9	2.21	1.58	0.33	54	9.12
1.58	0.34	10	4.05	1.58	0.33	55	9.13
1.58	0.34	11	5.90	1.58	0.34	56	9.13
1.58	0.34	12	7.85	1.58	0.35	57	9.13
1.58	0.34	13	9.79	1.58	0.34	58	9.15
1.58	0.34	14	9.75	1.58	0.34	59	9.16
1.58	0.34	15	9.70	1.58	0.34	60	9.16
1.58	0.34	16	9.62	1.58	0.34	61	9.18
1.58	0.34	17	9.55	1.58	0.34	62	9.19
1.58	0.34	18	9.49	1.58	0.36	63	9.21
1.58	0.34	19	9.42	1.58	0.35	64	9.23
1.58	0.34	20	9.39	1.58	0.34	65	9.23
1.58	0.34	21	9.35	1.59	0.34	66	9.22
1.58	0.34	22	9.32	1.58	0.34	67	9.22
1.58	0.34	23	9.29	1.58	0.35	68	8.93
1.58	0.34	24	9.27	1.58	0.34	69	4.05
1.58	0.34	25	9.25	1.97	0.00	70	2.64
1.58	0.34	26	9.22	1.97	0.00	71	1.23
1.58	0.34	27	9.19	1.97	0.00	72	0.89
1.58	0.34	28	9.17	1.97	0.00	73	0.55
1.58	0.34	29	9.15	1.97	0.00	74	0.47
1.58	0.34	30	9.14	1.97	0.00	75	0.39
1.58	0.34	31	9.12	1.97	0.00	76	0.34
1.58	0.34	32	9.11	1.97	0.00	77	0.30
1.58	0.34	33	9.10	1.97	0.00	78	0.27
1.58	0.34	34	9.09	1.97	0.00	79	0.25
1.58	0.34	35	9.08	1.97	0.00	80	0.24
1.58	0.34	36	9.08	1.97	0.00	81	0.23
1.58	0.34	37	9.08	1.97	0.00	82	0.20
1.58	0.34	38	9.08	1.97	0.00	83	0.18
1.58	0.34	39	9.08	1.97	0.00	84	0.16
1.58	0.34	40	9.08	1.97	0.00	85	0.14
1.58	0.34	41	9.06	1.97	0.00	86	0.14
1.58	0.34	42	9.06	1.97	0.00	87	0.14
1.58	0.34	43	9.05	1.97	0.00	88	0.14
1.59	0.34	44	9.08	1.97	0.00	89	0.14

Length	150	Concentration	10				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.11	1.58	0.33	45	8.93
1.97	0.00	1	0.11	1.58	0.34	46	8.93
1.97	0.00	2	0.11	1.59	0.34	47	8.93
1.97	0.00	3	0.11	1.58	0.34	48	8.93
1.97	0.00	4	0.11	1.58	0.35	49	8.95
1.97	0.00	5	0.07	1.58	0.34	50	8.95
1.97	0.00	6	0.07	1.58	0.34	51	8.95
1.97	0.00	7	0.07	1.58	0.34	52	8.95
1.97	0.00	8	0.07	1.58	0.34	53	8.97
1.97	0.00	9	2.22	1.58	0.34	54	8.98
1.58	0.34	10	5.12	1.58	0.35	55	8.98
1.58	0.34	11	8.03	1.58	0.34	56	8.97
1.58	0.34	12	8.94	1.58	0.34	57	8.97
1.58	0.34	13	9.85	1.58	0.34	58	8.97
1.58	0.34	14	9.80	1.58	0.34	59	8.97
1.58	0.34	15	9.75	1.58	0.34	60	8.99
1.58	0.34	16	9.67	1.58	0.35	61	9.00
1.58	0.34	17	9.59	1.58	0.34	62	9.00
1.58	0.34	18	9.52	1.58	0.34	63	9.00
1.58	0.34	19	9.46	1.58	0.36	64	9.01
1.58	0.34	20	9.39	1.58	0.34	65	9.01
1.58	0.34	21	9.32	1.58	0.33	66	9.02
1.58	0.34	22	9.27	1.58	0.35	67	9.01
1.58	0.34	23	9.22	1.58	0.34	68	8.64
1.58	0.34	24	9.19	1.58	0.33	69	4.13
1.58	0.34	25	9.16	1.97	0.00	70	2.70
1.58	0.34	26	9.13	1.97	0.00	71	1.27
1.58	0.34	27	9.10	1.97	0.00	72	0.92
1.58	0.34	28	9.07	1.97	0.00	73	0.56
1.58	0.34	29	9.05	1.97	0.00	74	0.48
1.58	0.34	30	9.04	1.97	0.00	75	0.40
1.58	0.34	31	9.04	1.97	0.00	76	0.35
1.58	0.34	32	9.03	1.97	0.00	77	0.30
1.58	0.34	33	9.02	1.97	0.00	78	0.28
1.58	0.34	34	9.00	1.97	0.00	79	0.25
1.58	0.34	35	8.98	1.97	0.00	80	0.24
1.58	0.34	36	8.97	1.97	0.00	81	0.22
1.58	0.34	37	8.95	1.97	0.00	82	0.20
1.58	0.34	38	8.95	1.97	0.00	83	0.18
1.58	0.34	39	8.95	1.97	0.00	84	0.16
1.58	0.34	40	8.93	1.97	0.00	85	0.14
1.58	0.35	41	8.92	1.97	0.00	86	0.14
1.59	0.34	42	8.92	1.97	0.00	87	0.14
1.58	0.34	43	8.94	1.97	0.00	88	0.15
1.58	0.34	44	8.94	1.97	0.00	89	0.15

Material	Teflon	Temperature	100				
Length	150	Concentration	25				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.24	0.98	0.97	46	24.12
1.97	0.00	1	0.24	0.97	0.97	47	24.14
1.97	0.00	2	0.14	0.98	0.97	48	24.23
1.97	0.00	3	0.14	0.97	0.98	49	24.30
1.97	0.00	4	0.14	0.98	0.98	50	24.36
1.97	0.00	5	0.14	0.98	0.97	51	24.34
1.97	0.00	6	0.14	0.98	0.98	52	24.40
1.97	0.00	7	0.14	0.97	0.97	53	24.44
1.97	0.00	8	0.14	0.97	0.97	54	24.48
1.97	0.00	9	0.14	0.98	0.98	55	24.49
0.98	0.98	10	4.81	0.97	0.97	56	24.52
0.98	0.98	11	9.47	0.98	0.98	57	24.54
0.98	0.98	12	15.46	0.98	0.98	58	24.59
0.98	0.98	13	21.46	0.97	0.98	59	24.61
0.98	0.98	14	22.26	0.98	0.97	60	24.64
0.98	0.98	15	23.05	0.97	0.97	61	24.66
0.98	0.98	16	23.13	0.98	0.97	62	24.69
0.98	0.98	17	23.21	0.98	0.98	63	24.72
0.98	0.98	18	23.26	0.98	0.98	64	24.77
0.98	0.98	19	23.30	0.98	0.97	65	24.79
0.98	0.98	20	23.36	0.97	0.98	66	24.83
0.98	0.98	21	23.42	0.98	0.97	67	24.81
0.98	0.98	22	23.45	0.97	0.98	68	24.84
0.98	0.98	23	23.48	0.98	0.97	69	24.89
0.98	0.98	24	23.51	0.98	0.97	70	22.06
0.98	0.98	25	23.54	1.91	0.40	71	12.24
0.98	0.98	26	23.56	1.97	0.00	72	7.53
0.98	0.98	27	23.59	1.97	0.00	73	2.82
0.98	0.98	28	23.60	1.97	0.00	74	2.11
0.98	0.98	29	23.60	1.97	0.00	75	1.39
0.98	0.98	30	23.64	1.97	0.00	76	1.20
0.98	0.98	31	23.68	1.97	0.00	77	1.02
0.98	0.98	32	23.69	1.97	0.00	78	0.93
0.98	0.98	33	23.70	1.97	0.00	79	0.83
0.98	0.98	34	23.74	1.97	0.00	80	0.77
0.98	0.98	36	23.77	1.97	0.00	81	0.70
0.98	0.98	37	23.79	1.97	0.00	82	0.66
0.98	0.98	38	23.81	1.97	0.00	83	0.61
0.98	0.98	39	23.83	1.97	0.00	84	0.58
0.98	0.98	40	23.86	1.97	0.00	85	0.56
0.98	0.97	41	23.91	1.97	0.00	86	0.53
0.98	0.97	42	23.97	1.97	0.00	87	0.50
0.98	0.98	43	23.95	1.97	0.00	88	0.48
0.98	0.97	44	24.01	1.97	0.00	89	0.46
0.98	0.98	45	24.08	1.97	0.00	90	0.40

Material	Teflon	Temperature	100				
Length	150	Concentration	25				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.33	0.98	0.97	45	24.26
1.97	0.00	1	0.33	0.98	0.97	46	24.30
1.97	0.00	2	0.32	0.97	0.97	47	24.31
1.97	0.00	3	0.32	0.98	0.97	48	24.32
1.97	0.00	4	0.27	0.97	0.98	49	24.33
1.97	0.00	5	0.27	0.98	0.98	50	24.37
1.97	0.00	6	0.27	0.98	0.98	51	24.38
1.97	0.00	7	0.27	0.98	0.98	52	24.41
1.97	0.00	8	0.27	0.98	0.97	53	24.42
1.97	0.00	9	0.27	0.98	0.97	54	24.46
0.98	0.98	10	5.95	0.98	0.97	55	24.45
0.98	0.98	11	11.64	0.98	0.98	56	24.47
0.98	0.98	12	16.77	0.98	0.98	57	24.50
0.98	0.98	13	21.91	0.98	0.97	58	24.52
0.98	0.98	14	22.89	0.98	0.97	59	24.55
0.98	0.98	15	23.88	0.97	0.97	60	24.57
0.98	0.98	16	23.95	0.98	0.97	61	24.58
0.98	0.98	17	24.01	0.98	0.97	62	24.62
0.98	0.98	18	24.02	0.98	0.97	63	24.64
0.98	0.98	19	24.04	0.98	0.97	64	24.65
0.98	0.98	20	24.05	0.98	0.97	65	24.66
0.98	0.98	21	24.06	0.98	0.98	66	24.69
0.98	0.98	22	24.05	0.98	0.97	67	24.74
0.98	0.98	23	24.05	0.98	0.97	68	24.73
0.98	0.98	24	24.06	0.97	0.97	69	22.62
0.98	0.98	25	24.08	1.97	0.03	70	18.14
0.98	0.98	26	24.07	1.97	0.03	71	13.66
0.98	0.98	27	24.06	1.97	0.03	72	8.46
0.98	0.98	28	24.08	1.97	0.03	73	3.26
0.98	0.98	29	24.11	1.97	0.03	74	2.35
0.98	0.98	30	24.10	1.97	0.03	75	1.44
0.98	0.98	31	24.10	1.97	0.03	76	1.26
0.98	0.98	32	24.11	1.97	0.01	77	1.08
0.98	0.98	33	24.13	1.97	0.01	78	0.98
0.98	0.98	34	24.13	1.97	0.00	79	0.88
0.98	0.98	35	24.14	1.97	0.00	80	0.83
0.98	0.98	36	24.14	1.97	0.00	81	0.78
0.98	0.98	37	24.15	1.97	0.00	82	0.84
0.98	0.98	38	24.14	1.97	0.00	83	0.91
0.98	0.98	39	24.14	1.97	0.00	84	0.74
0.98	0.98	40	24.18	1.97	0.00	85	0.57
0.98	0.97	41	24.17	1.97	0.00	86	0.31
0.98	0.98	42	24.21	1.97	0.00	87	0.04
0.98	0.97	43	24.22	1.97	0.00	88	0.02
0.97	0.98	44	24.24	1.97	0.00	89	0.00

Material	Teflon	Temperature	100				
Length	150	Concentration	25				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.27	0.98	0.97	45	23.97
1.97	0.00	1	0.28	0.98	0.98	46	24.01
1.97	0.00	2	0.23	0.98	0.98	47	24.01
1.97	0.00	3	0.23	0.98	0.97	48	24.05
1.97	0.00	4	0.23	0.97	0.97	49	24.07
1.97	0.00	5	0.23	0.98	0.97	50	24.13
1.97	0.00	6	0.23	0.98	0.97	51	24.11
1.97	0.00	7	0.23	0.98	0.98	52	24.14
1.97	0.00	8	0.23	0.98	0.98	53	24.16
1.97	0.00	9	2.55	0.97	0.97	54	24.19
0.98	0.98	10	8.03	0.97	0.97	55	24.19
0.98	0.98	11	13.50	0.97	0.98	56	24.22
0.98	0.98	12	18.06	0.97	0.97	57	24.24
0.98	0.98	13	22.61	0.98	0.97	58	24.26
0.98	0.98	14	23.00	0.97	0.97	59	24.27
0.98	0.98	15	23.39	0.98	0.97	60	24.33
0.98	0.98	16	23.45	0.97	0.97	61	24.34
0.98	0.98	17	23.50	0.98	0.97	62	24.42
0.98	0.98	18	23.53	0.98	0.97	63	24.44
0.98	0.98	19	23.57	0.97	0.97	64	24.45
0.98	0.98	20	23.60	0.98	0.97	65	24.46
0.98	0.98	21	23.63	0.98	0.97	66	24.56
0.98	0.98	22	23.65	0.98	0.98	67	24.57
0.98	0.98	23	23.66	0.97	0.97	68	24.56
0.98	0.98	24	23.68	0.98	0.97	69	22.20
0.98	0.98	25	23.69	1.97	0.00	70	16.77
0.98	0.98	26	23.70	1.97	0.00	71	11.34
0.98	0.98	27	23.71	1.97	0.00	72	6.83
0.98	0.98	28	23.73	1.97	0.00	73	2.31
0.98	0.98	29	23.75	1.97	0.00	74	1.79
0.98	0.98	30	23.74	1.97	0.00	75	1.26
0.98	0.98	31	23.74	1.97	0.00	76	1.11
0.98	0.98	32	23.76	1.97	0.00	77	0.95
0.98	0.98	33	23.78	1.97	0.00	78	0.86
0.98	0.98	34	23.79	1.97	0.00	79	0.77
0.98	0.98	35	23.81	1.97	0.00	80	0.71
0.98	0.98	36	23.82	1.97	0.00	81	0.65
0.98	0.98	37	23.83	1.97	0.00	82	0.61
0.98	0.98	38	23.83	1.97	0.00	83	0.57
0.98	0.98	39	23.83	1.97	0.00	84	0.54
0.97	0.98	40	23.87	1.97	0.00	85	0.51
0.97	0.97	41	23.89	1.97	0.00	86	0.49
0.98	0.98	42	23.91	1.97	0.00	87	0.47
0.98	0.97	43	23.92	1.97	0.00	88	0.47
0.98	0.97	44	23.96	1.97	0.00	89	0.47

Material	Teflon	Temperature	100				
Length	150	Concentration	35				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.12	0.56	1.38	45	34.03
2.00	0.00	1	0.12	0.56	1.38	46	35.07
1.97	0.00	2	0.12	0.56	1.38	47	35.35
1.97	0.00	3	0.12	0.56	1.38	48	34.74
1.97	0.00	4	0.12	0.56	1.38	49	34.28
1.97	0.00	5	0.12	0.56	1.38	50	34.92
1.97	0.00	6	0.12	0.56	1.38	51	34.17
1.97	0.00	7	0.16	0.56	1.38	52	34.65
1.97	0.00	8	0.16	0.56	1.38	53	34.07
1.97	0.00	9	1.74	0.56	1.38	54	34.38
0.56	1.38	10	6.46	0.56	1.38	55	35.47
0.56	1.38	11	11.17	0.56	1.38	56	33.71
0.56	1.38	12	22.23	0.56	1.38	57	32.43
0.56	1.38	13	33.29	0.56	1.38	58	32.45
0.56	1.38	14	33.92	0.56	1.38	59	32.47
0.56	1.38	15	34.55	0.56	1.38	60	33.74
0.56	1.38	16	34.57	0.56	1.38	61	35.87
0.56	1.38	17	34.58	0.56	1.38	62	34.54
0.56	1.38	18	34.15	0.56	1.38	63	35.60
0.56	1.38	19	35.70	0.56	1.38	64	34.94
0.56	1.38	20	35.40	0.56	1.38	65	35.74
0.56	1.38	21	34.34	0.56	1.38	66	34.17
0.56	1.38	22	34.64	0.56	1.38	67	35.87
0.56	1.38	23	35.83	0.56	1.38	68	34.30
0.56	1.38	24	35.38	0.56	1.38	69	33.59
0.56	1.38	25	34.93	1.92	0.36	70	9.89
0.56	1.38	26	33.87	1.97	0.07	71	1.85
0.56	1.38	27	32.74	1.97	0.05	72	1.23
0.56	1.38	28	31.98	1.97	0.03	73	0.84
0.56	1.38	29	31.23	1.97	0.01	74	0.61
0.56	1.38	30	32.34	1.97	0.00	75	0.60
0.56	1.38	31	33.45	1.97	0.00	76	0.58
0.56	1.38	32	34.23	1.97	0.00	77	0.50
0.56	1.38	33	35.97	1.97	0.00	78	0.46
0.56	1.38	34	34.85	1.97	0.00	79	0.41
0.56	1.38	35	35.00	1.97	0.00	80	0.34
0.56	1.38	36	34.80	1.97	0.00	81	0.26
0.56	1.38	37	34.27	1.97	0.00	82	0.21
0.56	1.38	38	35.48	1.97	0.00	83	0.22
0.56	1.38	39	35.14	1.97	0.00	84	0.22
0.56	1.38	40	34.46	1.97	0.00	85	0.24
0.56	1.38	41	35.56	1.97	0.00	86	0.24
0.56	1.38	42	34.11	1.97	0.00	87	0.24
0.56	1.38	43	34.63	1.97	0.00	88	0.17
0.56	1.38	44	35.05	1.97	0.00	89	0.13

Material	Teflon	Temperature	100				
Length	150	Concentration	35				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.08	0.53	1.30	45	34.94
1.97	0.00	1	0.05	0.53	1.30	46	34.65
1.97	0.00	2	0.05	0.53	1.30	47	34.35
1.97	0.00	3	0.86	0.53	1.30	48	35.18
1.10	0.00	4	0.86	0.53	1.30	49	34.92
1.97	0.00	5	0.86	0.53	1.30	50	34.32
1.97	0.00	6	0.86	0.53	1.30	51	34.16
1.97	0.00	7	1.13	0.53	1.30	53	35.64
1.97	0.00	8	0.71	0.53	1.30	54	35.56
1.97	0.00	9	2.62	0.53	1.30	55	34.45
0.53	1.30	10	15.20	0.53	1.30	56	35.01
0.53	1.30	11	27.77	0.53	1.30	57	34.27
0.53	1.30	12	31.90	0.53	1.30	58	34.48
0.53	1.30	13	35.79	0.53	1.31	59	33.82
0.53	1.30	14	35.33	0.53	1.31	60	31.37
0.53	1.30	15	35.42	0.53	1.31	61	32.59
0.53	1.30	16	34.61	0.53	1.31	62	33.82
0.53	1.30	17	35.81	0.53	1.31	63	35.66
0.53	1.30	18	34.01	0.53	1.31	64	34.56
0.53	1.30	19	34.10	0.53	1.31	65	34.04
0.53	1.30	20	35.42	0.53	1.31	66	34.15
0.53	1.30	21	34.25	0.53	1.31	67	34.55
0.53	1.30	22	34.77	0.53	1.31	68	34.18
0.53	1.30	23	34.07	0.53	1.30	69	33.17
0.53	1.30	24	35.96	0.53	1.30	70	32.16
0.53	1.30	25	34.95	1.94	0.14	71	26.98
0.53	1.30	26	35.07	1.98	0.08	72	3.37
0.53	1.30	27	34.55	1.98	0.08	73	1.98
0.53	1.30	28	35.92	1.98	0.05	74	1.51
0.53	1.30	29	34.14	1.96	0.01	75	1.22
0.53	1.30	30	34.21	1.97	0.00	76	1.05
0.53	1.30	31	35.23	1.98	0.00	77	0.94
0.53	1.30	32	35.85	1.97	0.00	78	0.83
0.53	1.30	33	35.09	1.97	0.00	79	0.72
0.53	1.30	34	34.74	1.97	0.00	80	0.68
0.53	1.30	35	34.70	1.97	0.00	81	0.65
0.53	1.30	36	34.13	1.97	0.00	82	0.59
0.53	1.30	37	34.94	1.97	0.00	83	0.44
0.53	1.30	38	32.06	1.97	0.00	84	0.31
0.53	1.30	39	28.76	1.96	0.00	85	0.37
0.53	1.30	40	27.63	1.97	0.00	86	0.37
0.53	1.30	41	26.50	1.97	0.00	87	0.35
0.53	1.30	42	29.84	1.97	0.00	88	0.40
0.53	1.30	43	33.19	1.97	0.00	89	0.31
0.53	1.30	44	34.07	1.97	0.00	90	0.26

Material	Teflon	Temperature	100				
Length	150	Concentration	35				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.97	0.00	0	0.24	0.53	1.30	45	34.90
1.97	0.00	1	0.24	0.53	1.30	46	35.81
1.97	0.00	2	0.19	0.53	1.30	47	34.66
1.97	0.00	3	0.17	0.53	1.30	48	34.38
1.97	0.00	4	0.22	0.53	1.30	49	34.43
1.96	0.00	5	0.24	0.53	1.30	50	35.07
1.97	0.00	6	0.24	0.53	1.30	51	35.41
1.97	0.00	7	0.23	0.53	1.30	53	34.09
1.97	0.00	8	0.21	0.53	1.30	54	33.18
1.97	0.00	9	0.42	0.53	1.30	55	33.49
0.53	1.31	10	4.64	0.53	1.30	56	33.80
0.53	1.31	11	8.86	0.53	1.30	57	34.40
0.53	1.31	12	19.35	0.53	1.30	58	34.62
0.53	1.31	13	29.84	0.53	1.30	59	35.65
0.53	1.31	14	31.02	0.53	1.30	60	35.03
0.53	1.31	15	32.20	0.53	1.30	61	34.23
0.53	1.31	16	33.60	0.53	1.30	62	35.94
0.53	1.31	17	35.33	0.53	1.30	63	35.10
0.53	1.31	18	35.56	0.53	1.30	64	35.53
0.53	1.30	19	34.15	0.53	1.30	65	35.11
0.53	1.30	20	33.31	0.53	1.30	66	35.14
0.53	1.30	21	31.63	0.53	1.30	67	27.66
0.53	1.30	22	31.27	0.53	1.30	68	20.33
0.53	1.30	23	30.91	0.53	1.30	69	18.44
0.53	1.30	24	32.95	0.53	1.30	70	16.55
0.53	1.30	25	35.44	1.94	0.15	71	9.98
0.53	1.30	26	35.44	1.96	0.12	72	3.33
0.53	1.30	27	34.71	1.96	0.08	73	1.99
0.53	1.30	28	34.65	1.97	0.03	74	1.52
0.53	1.30	29	35.45	1.96	0.01	75	1.06
0.53	1.30	30	34.93	1.97	0.00	76	0.89
0.53	1.30	31	35.49	1.96	0.00	77	0.93
0.53	1.30	32	34.43	1.97	0.00	78	0.83
0.53	1.30	33	34.82	1.96	0.00	79	0.74
0.53	1.30	34	34.14	1.97	0.00	80	0.68
0.53	1.30	35	35.41	1.96	0.00	81	0.55
0.53	1.30	36	34.16	1.97	0.00	82	0.46
0.53	1.30	37	34.29	1.96	0.00	83	0.40
0.53	1.30	38	35.09	1.97	0.00	84	0.28
0.53	1.30	39	35.95	1.97	0.00	85	0.31
0.53	1.30	40	34.80	1.97	0.00	86	0.32
0.53	1.30	41	35.79	1.98	0.00	87	0.35
0.53	1.30	42	34.08	1.97	0.00	88	0.27
0.53	1.30	43	34.60	1.97	0.00	89	0.14
0.53	1.30	44	35.62	1.97	0.00	90	0.24

Material	Teflon	Temperature	100				
Length	150	Concentration	2				
Trial	1						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
1.99	0.00	0	0.01	1.92	0.10	45	0.91
1.99	0.00	1	0.01	1.92	0.10	46	0.92
1.99	0.00	2	0.01	1.92	0.10	47	0.93
1.99	0.00	3	0.01	1.92	0.10	48	0.93
1.99	0.00	4	0.00	1.92	0.10	49	0.93
1.99	0.00	5	0.00	1.92	0.10	50	0.93
1.99	0.00	6	0.00	1.92	0.10	51	0.94
1.99	0.00	7	0.00	1.92	0.10	52	0.93
1.99	0.00	8	0.00	1.92	0.10	53	0.92
1.99	0.00	9	0.00	1.92	0.10	54	0.91
1.92	0.10	10	0.12	1.92	0.10	55	0.90
1.92	0.10	11	0.24	1.92	0.10	56	0.91
1.92	0.10	12	0.48	1.92	0.10	57	0.92
1.92	0.10	13	0.72	1.92	0.10	58	0.93
1.92	0.10	14	0.88	1.92	0.10	59	0.94
1.92	0.10	15	1.04	1.92	0.10	60	0.93
1.92	0.10	16	1.06	1.92	0.10	61	0.93
1.92	0.10	17	1.08	1.92	0.10	62	0.93
1.92	0.10	18	0.97	1.92	0.10	63	0.93
1.92	0.10	19	0.87	1.92	0.10	64	0.92
1.92	0.10	20	0.84	1.92	0.10	65	0.90
1.92	0.10	21	0.82	1.92	0.10	66	0.87
1.92	0.10	22	0.91	1.92	0.10	67	0.83
1.92	0.10	23	0.99	1.92	0.10	68	0.63
1.92	0.10	24	0.99	1.99	0.10	69	0.43
1.92	0.10	25	0.98	1.99	0.02	70	0.06
1.92	0.10	26	0.96	1.99	0.01	71	0.02
1.92	0.10	27	0.93	2.00	0.00	72	0.00
1.92	0.10	28	0.92	2.00	0.00	73	0.00
1.92	0.10	29	0.91	1.99	0.00	74	0.00
1.92	0.10	30	0.91	2.00	0.00	75	0.00
1.92	0.10	31	0.91	2.00	0.00	76	0.00
1.92	0.10	32	0.90	2.00	0.00	77	0.00
1.92	0.10	33	0.89	2.00	0.00	78	0.00
1.92	0.10	34	0.82	1.99	0.00	79	0.00
1.92	0.10	35	0.76	2.00	0.00	80	0.00
1.92	0.10	36	0.78	2.00	0.00	81	0.00
1.92	0.10	37	0.80	2.00	0.00	82	0.00
1.92	0.10	38	0.86	1.99	0.00	83	0.00
1.92	0.10	39	0.93	2.00	0.00	84	0.00
1.92	0.10	40	0.93	1.99	0.00	85	0.00
1.92	0.10	41	0.93	2.00	0.00	86	0.00
1.92	0.10	42	0.92	2.00	0.00	87	0.00
1.92	0.10	43	0.91	1.99	0.00	88	0.00
1.92	0.10	44	0.91	1.99	0.00	89	0.00

Material	Teflon	Temperature	100				
Length	150	Concentration	2				
Trial	2						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.00	1.92	0.10	46	1.03
2.00	0.00	1	0.00	1.92	0.10	47	1.04
2.00	0.00	2	0.00	1.92	0.10	48	1.04
2.00	0.00	3	0.00	1.92	0.10	49	1.03
2.00	0.00	4	0.00	1.92	0.10	50	1.03
2.00	0.00	5	0.00	1.92	0.10	51	0.98
2.00	0.00	6	0.00	1.92	0.10	52	0.93
2.00	0.00	7	0.00	1.92	0.10	53	0.84
2.00	0.00	8	0.00	1.92	0.10	54	0.75
1.99	0.10	9	0.00	1.92	0.10	55	0.80
1.92	0.10	10	0.25	1.92	0.10	56	0.84
1.92	0.10	11	0.50	1.92	0.10	57	0.94
1.92	0.10	12	0.86	1.92	0.10	58	1.03
1.92	0.10	13	1.22	1.92	0.10	59	1.03
1.92	0.10	14	1.35	1.92	0.10	60	1.03
1.92	0.10	15	1.48	1.92	0.10	61	1.03
1.92	0.10	16	1.42	1.92	0.10	62	1.03
1.92	0.10	17	1.37	1.92	0.10	63	1.03
1.92	0.10	18	1.06	1.92	0.10	64	1.03
1.92	0.10	19	0.75	1.92	0.10	65	1.02
1.92	0.10	20	0.76	1.92	0.10	66	1.02
1.92	0.10	21	0.77	1.92	0.10	67	0.97
1.92	0.10	22	1.01	1.92	0.10	68	0.93
1.92	0.10	23	1.25	1.92	0.10	69	0.72
1.92	0.10	24	1.22	2.00	0.10	70	0.52
1.92	0.10	25	1.20	2.00	0.02	71	0.12
1.92	0.10	26	1.16	1.99	0.01	72	0.03
1.92	0.10	27	1.13	2.00	0.00	73	0.00
1.92	0.10	28	1.02	1.99	0.00	74	0.00
1.92	0.10	29	0.91	2.00	0.00	75	0.00
1.92	0.10	30	0.91	2.00	0.00	76	0.00
1.92	0.10	31	0.90	1.99	0.00	77	0.00
1.92	0.10	32	1.00	1.99	0.00	78	0.00
1.92	0.10	33	1.09	2.00	0.00	79	0.00
1.92	0.10	34	1.09	1.99	0.00	80	0.00
1.92	0.10	36	1.08	2.01	0.00	81	0.00
1.92	0.10	37	1.08	2.00	0.00	82	0.00
1.92	0.10	38	1.07	1.99	0.00	83	0.00
1.92	0.10	39	1.07	2.00	0.00	84	0.00
1.92	0.10	40	1.06	2.00	0.00	85	0.00
1.92	0.10	41	1.06	2.00	0.00	86	0.00
1.92	0.10	42	1.06	2.00	0.00	87	0.00
1.92	0.10	43	1.04	2.00	0.00	88	0.00
1.92	0.10	44	1.03	2.00	0.00	89	0.00
1.92	0.10	45	1.03				

Material	Teflon	Temperature	100				
Length	150	Concentration	2				
Trial	3						
Air (LPM)	NH3 (LPM)	T (M)	C (PPM)	Air (LPM)	NH3 (LPM)	T (M)	C (PPM)
2.00	0.00	0	0.00	1.92	0.10	45	0.91
2.00	0.00	1	0.00	1.92	0.10	46	1.00
2.00	0.00	2	0.00	1.92	0.10	47	1.09
2.00	0.00	3	0.00	1.92	0.10	48	0.98
2.00	0.00	4	0.00	1.92	0.10	49	0.88
2.00	0.00	5	0.00	1.92	0.10	50	0.82
2.00	0.00	6	0.00	1.92	0.10	51	0.77
2.00	0.00	7	0.00	1.92	0.10	52	0.83
2.00	0.00	8	0.00	1.92	0.10	53	0.89
2.00	0.00	9	0.00	1.92	0.10	54	0.93
1.92	0.10	10	0.31	1.92	0.10	55	0.98
1.92	0.10	11	0.62	1.92	0.10	56	1.02
1.92	0.10	12	1.04	1.92	0.10	58	1.06
1.92	0.10	13	1.46	1.92	0.10	59	1.07
1.92	0.10	14	1.53	1.92	0.10	60	1.08
1.92	0.10	15	1.61	1.92	0.10	61	1.08
1.92	0.10	16	1.43	1.92	0.10	62	1.08
1.92	0.10	17	1.26	1.92	0.10	63	1.03
1.92	0.10	18	1.23	1.92	0.10	64	0.98
1.92	0.10	19	1.21	1.92	0.10	65	0.93
1.92	0.10	20	1.30	1.92	0.10	66	0.89
1.92	0.10	21	1.38	1.92	0.10	67	0.89
1.92	0.10	22	1.17	1.92	0.10	68	0.90
1.92	0.10	23	0.96	1.92	0.10	69	0.72
1.92	0.10	24	0.82	1.92	0.10	70	0.54
1.92	0.10	25	0.69	2.00	0.01	71	0.12
1.92	0.10	26	0.76	2.00	0.01	72	0.02
1.92	0.10	27	0.84	2.00	0.00	73	0.00
1.92	0.10	28	0.75	2.00	0.00	74	0.00
1.92	0.10	29	0.66	2.00	0.00	75	0.00
1.92	0.10	30	0.63	1.99	0.00	76	0.00
1.92	0.10	31	0.59	2.00	0.00	77	0.00
1.92	0.10	32	0.72	2.00	0.00	78	0.00
1.92	0.10	33	0.85	2.00	0.00	79	0.00
1.92	0.10	34	0.83	2.00	0.00	80	0.00
1.92	0.10	35	0.82	2.00	0.00	81	0.00
1.92	0.10	36	0.80	2.00	0.00	82	0.00
1.92	0.10	37	0.78	2.00	0.00	83	0.00
1.92	0.10	38	0.84	2.00	0.00	84	0.00
1.92	0.10	39	0.89	2.00	0.00	85	0.00
1.92	0.10	40	0.90	2.00	0.00	86	0.00
1.92	0.10	41	0.92	2.00	0.00	87	0.00
1.92	0.10	42	0.86	2.00	0.00	88	0.00
1.92	0.10	43	0.81	1.99	0.00	89	0.00
1.92	0.10	44	0.86	1.99	0.00	90	0.00

APPENDIX D

D.1 AMMONIA CONCENTRATION MEASUREMENTS

The following 60 tables present each minute of data collected over the summer and winter sampling trips. Figure D-1 displays the heading common to each measurement. The location, starting time, and date are provided in the upper left corner of the table. The headings specific to each measurement are (from left to right): minutes (since sample began), concentration of ammonia (in parts per million – PPM), ambient temperature (^oC), flux chamber temperature (^oC), and source temperature (^oC). The time of year of the sample (summer or winter) is also expressed in the heading for each sample. The headings are repeated for a second set of columns indicating the final half of the experiment.

Location:									
Start Time:									
DATE:									
Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC	Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC

Figure D-1. Sample Ammonia Measurement Heading.

DATE:	8/5/2002	Summer	Location:	Compost							
Time	8:37 AM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.09	27.91	30.71	36.13	e	31	0.11	1.22	30.71	35.70	e
1	0.38	28.31	31.12	36.13	e	32	0.10	1.21	30.71	35.70	e
2	0.08	28.31	30.71	36.13	e	33	0.11	1.23	30.71	36.13	e
3	0.08	28.31	30.71	36.13	e	34	0.11	1.23	31.12	36.13	e
4	0.06	28.31	30.71	36.13	e	35	0.11	1.23	31.12	36.13	e
5	0.06	28.70	31.12	36.13	e	36	0.10	1.24	31.12	36.57	e
6	0.05	28.70	31.12	36.13	e	37	0.10	1.23	31.12	36.57	e
7	0.06	28.70	31.12	36.13	e	38	0.11	1.24	31.12	36.57	e
8	0.05	28.70	31.52	36.13	e	39	0.11	1.26	31.12	37.00	e
9	0.05	28.70	31.52	36.13	e	40	0.11	1.25	31.12	37.00	e
10	0.04	28.70	31.93	36.13	e	41	0.11	1.27	31.12	37.44	e
11	0.04	28.70	31.93	36.13	e	42	0.10	1.26	31.52	37.44	e
12	0.04	29.10	31.93	36.13	e	43	0.10	1.26	31.52	37.44	e
13	0.04	1.04	29.10	32.34	e	44	0.11	1.28	31.52	37.88	e
14	0.04	1.04	29.10	32.34	e	45	0.10	1.27	31.52	37.88	e
15	0.04	1.05	29.10	32.76	e	46	0.11	1.28	31.52	37.88	e
16	0.04	1.05	29.50	32.76	e	47	0.10	1.29	31.93	38.32	e
17	0.03	1.05	29.50	32.76	e	48	0.10	1.29	31.93	38.32	e
18	0.03	1.06	29.50	33.17	e	49	0.09	1.30	31.93	38.77	e
19	0.03	1.06	29.50	33.17	e	50	0.10	1.30	31.93	38.77	e
20	0.03	1.07	29.90	33.59	e	51	0.08	1.28	32.34	38.77	e
21	0.03	1.08	29.90	33.59	e	52	0.09	1.31	32.34	39.22	e
22	0.04	1.09	29.90	34.01	e	53	0.07	1.29	32.34	39.22	e
23	0.04	1.10	29.90	34.01	e	54	0.07	1.30	32.34	39.67	e
24	0.06	1.12	29.90	34.01	e	55	0.07	1.30	32.76	39.67	e
25	0.08	1.14	30.31	34.43	e	56	0.08	1.31	32.76	39.67	e
26	0.09	1.15	30.31	34.43	e	57	0.03	1.26	32.76	39.67	e
27	0.09	1.17	30.31	34.85	e	58	0.00	1.24	32.76	40.13	e
28	0.10	1.18	30.31	34.85	e	59	0.12	1.37	32.76	40.13	e
29	0.11	1.19	30.31	34.85	e	60	0.13	1.37	32.76	40.13	e
30	0.11	1.20	30.31	35.27	e						

DATE:	8/5/2002	Summer	Location:	Compost							
Time	10:12 AM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.06	28.70	37.88	39.22	e	31	0.11	1.43	35.70	42.46	e
1	0.13	29.50	37.88	39.22	e	32	0.10	1.42	35.70	42.46	e
2	0.13	33.17	43.42	39.22	e	33	0.11	1.42	35.70	42.46	e
3	0.12	33.59	42.94	39.22	e	34	0.09	1.41	35.70	42.46	e
4	0.12	34.43	42.94	39.22	e	35	0.09	1.41	35.70	42.46	e
5	0.14	34.43	42.94	39.22	e	36	0.09	1.41	35.70	42.46	e
6	0.14	34.85	42.94	39.22	e	37	0.09	1.41	35.70	42.46	e
7	0.15	34.85	42.94	39.22	e	38	0.09	1.41	35.70	42.46	e
8	0.15	35.27	42.94	39.67	e	39	0.10	1.42	36.13	42.46	e
9	0.15	35.27	42.46	39.22	e	40	0.09	1.40	36.13	42.46	e
10	0.15	35.27	42.46	39.67	e	41	0.09	1.40	36.13	42.46	e
11	0.14	35.70	42.46	39.67	e	42	0.09	1.41	36.13	42.46	e
12	0.14	35.70	42.46	39.67	e	43	0.09	1.41	36.13	42.46	e
13	0.14	1.45	35.70	42.46	e	44	0.09	1.41	36.13	42.46	e
14	0.14	1.45	35.70	42.46	e	45	0.10	1.41	36.57	42.46	e
15	0.13	1.45	35.70	42.46	e	46	0.10	1.42	36.57	42.46	e
16	0.13	1.44	35.70	42.46	e	47	0.10	1.41	37.00	42.46	e
17	0.12	1.44	36.13	42.46	e	48	0.09	1.42	37.00	42.94	e
18	0.12	1.42	36.13	41.99	e	49	0.09	1.42	37.00	42.94	e
19	0.12	1.42	35.70	41.99	e	50	0.09	1.43	37.00	42.94	e
20	0.12	1.42	35.70	41.99	e	51	0.09	1.43	37.00	42.94	e
21	0.12	1.42	35.70	41.99	e	52	0.08	1.41	37.00	42.94	e
22	0.13	1.43	35.70	41.99	e	53	0.09	1.42	37.00	42.94	e
23	0.13	1.43	35.70	41.99	e	54	0.09	1.43	37.00	43.42	e
24	0.10	1.40	36.13	41.99	e	55	0.10	1.44	36.57	43.42	e
25	0.12	1.42	36.13	41.99	e	56	0.07	1.41	37.00	43.42	e
26	0.12	1.42	36.13	41.99	e	57	0.07	1.42	36.57	43.42	e
27	0.11	1.42	36.13	41.99	e	58	0.07	1.44	36.57	43.91	e
28	0.12	1.42	35.70	41.99	e	59	0.08	1.42	34.01	43.42	e
29	0.13	1.43	35.70	41.99							
30	0.13	1.44	35.70	42.46							

DATE:	8/5/2002	Summer	Location:	Compost							
Time	11:18 AM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.0929	32.34	46.4	34.01	e	31	0.554	2.12	40.13	50.66	e
1	0.0348	33.17	46.4	34.01	e	32	0.501	2.07	40.59	50.66	e
2	0.1174	33.17	45.89	34.43	e	33	0.521	2.09	41.05	50.66	e
3	0.0955	33.59	45.39	34.43	e	34	0.413	1.98	41.05	50.66	e
4	0.1048	34.01	45.39	34.43	e	35	0.52	2.09	41.05	50.66	e
5	0.0982	34.85	45.39	34.43	e	36	0.551	2.12	41.05	50.66	e
6	0.218	35.27	45.89	34.43	e	37	0.562	2.13	41.05	50.66	e
7	0.3	35.27	45.89	34.43	e	38	0.52	2.09	41.05	50.66	e
8	0.353	35.70	45.89	34.43	e	39	0.49	2.06	40.59	50.66	e
9	0.394	36.57	45.89	34.43	e	40	0.426	1.98	40.13	50.11	e
10	0.425	36.57	46.4	34.43	e	41	0.313	1.85	39.67	49.56	e
11	0.472	37.00	46.4	34.85	e	42	0.542	2.06	39.22	49.02	e
12	0.478	37.44	46.91	34.85	e	43	0.545	2.06	38.77	49.02	e
13	0.483	1.93	37.88	46.91	e	44	0.615	2.15	39.22	49.56	e
14	0.517	1.98	37.88	47.43	e	45	0.641	2.19	39.22	50.11	e
15	0.546	2.01	37.88	47.43	e	46	0.659	2.23	39.67	50.66	e
16	0.546	2.01	37.88	47.43	e	47	0.66	2.23	40.13	50.66	e
17	0.6	2.08	38.32	47.96	e	48	0.702	2.27	40.59	50.66	e
18	0.617	2.10	38.32	47.96	e	49	0.773	2.32	41.05	50.11	e
19	0.593	2.08	38.77	47.96	e	50	0.671	2.20	41.05	49.56	e
20	0.627	2.13	38.77	48.49	e	51	0.726	2.26	41.05	49.56	e
21	0.532	2.03	39.22	48.49	e	52	0.719	2.25	41.05	49.56	e
22	0.522	2.04	39.67	49.02	e	53	0.762	2.31	41.52	50.11	e
23	0.503	2.02	39.22	49.02	e	54	0.744	2.31	41.99	50.66	e
24	0.581	2.11	39.22	49.56	e	55	0.689	2.24	41.99	50.11	e
25	0.511	2.04	38.77	49.56	e	56	0.678	2.23	41.99	50.11	e
26	0.552	2.09	38.77	49.56	e	57	0.678	2.23	41.99	50.11	e
27	0.578	2.11	38.77	49.56	e						
28	0.589	2.14	38.77	50.11	e						
29	0.619	2.17	38.77	50.11	e						
30	0.557	2.11	39.67	50.11	e						

DATE:	8/5/02	Summer	Location:	Compost							
Time	2:14 PM		Sample:	4							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Out	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Out
0	0.06	35.27	34.43	34.85	9.97	31	26.40	27.65	37.88	45.39	5.04
1	0.25	35.27	35.70	34.43	9.97	32	26.30	27.55	37.88	45.39	5.05
2	9.39	37.44	37.00	40.59	10.02	33	25.90	27.15	38.32	45.39	5.03
3	25.30	37.88	41.05	41.99	10.10	34	25.70	26.97	37.88	45.89	5.04
4	26.20	38.32	43.91	42.46	10.04	35	25.80	27.08	37.88	46.40	5.04
5	26.20	38.77	45.39	42.46	10.03	36	25.90	27.20	37.88	46.91	5.04
6	26.30	38.77	45.89	42.46	10.04	37	26.00	27.30	37.88	46.91	5.04
7	26.30	39.22	45.89	42.46	10.04	38	26.10	27.41	37.88	47.43	5.05
8	26.40	39.22	45.89	42.46	10.02	39	26.10	27.41	37.88	47.43	5.04
9	26.50	39.67	45.89	42.46	10.02	40	26.10	27.41	37.88	47.43	5.06
10	26.50	39.22	45.89	42.46	10.08	41	26.10	27.41	37.88	47.43	5.04
11	26.60	38.77	45.39	42.46	10.07	42	26.10	27.40	37.44	46.91	5.05
12	26.60	38.32	44.40	42.46	10.03	43	26.10	27.40	37.44	46.91	5.05
13	26.60	27.82	37.88	44.40	10.03	44	26.00	27.30	37.00	46.91	5.05
14	26.60	27.80	37.44	43.91	10.08	45	26.00	27.31	37.00	47.43	5.04
15	26.60	27.80	37.00	43.91	10.10	46	26.10	27.41	37.00	47.43	5.03
16	26.30	27.52	37.00	44.40	10.05	47	26.10	27.43	37.00	47.96	5.05
17	26.10	27.33	37.00	44.89	10.04	48	26.10	27.43	37.00	47.96	5.05
18	26.20	27.45	37.00	45.39	10.06	49	26.10	27.41	37.00	47.43	5.03
19	26.30	27.55	37.00	45.39	9.91	50	26.20	27.51	37.44	47.43	5.03
20	26.40	27.65	37.44	45.39	10.06	51	26.10	27.41	37.44	47.43	5.04
21	26.40	27.65	37.88	45.39	10.04	52	26.20	27.53	37.88	47.96	5.04
22	26.40	27.65	37.88	45.39	10.04	53	26.20	27.53	37.88	47.96	5.03
23	26.30	27.55	38.32	45.39	10.00	54	26.20	27.55	37.88	48.49	5.04
24	26.20	27.45	38.32	45.39	10.10	55	26.20	27.55	38.32	48.49	5.04
25	26.20	27.43	37.44	44.89	10.12	56	26.20	27.55	38.32	48.49	5.05
26	26.20	27.42	37.00	44.40	10.01						
27	26.30	27.52	37.00	44.40	10.04						
28	26.30	27.53	37.00	44.89	10.02						
29	26.40	27.63	37.44	44.89	10.04						
30	26.30	27.53	37.88	44.89	10.02						

DATE:	8/5/02	Summer	Location:	Compost							
Time	5:33 PM		Sample:	5							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.39	33.59	34.43	34.43	10.04	31	0.40	1.58	38.32	38.32	10.10
1	0.40	34.01	34.85	40.13	10.04	32	0.35	1.55	38.32	38.77	5.06
2	0.36	34.01	34.85	41.05	10.04	33	0.32	1.52	38.32	38.77	5.05
3	11.37	34.01	34.85	41.52	10.07	34	0.31	1.51	38.32	38.77	5.02
4	16.96	34.43	34.85	41.52	9.95	35	0.30	1.50	38.32	38.77	5.06
5	16.23	34.85	34.85	41.52	10.09	36	0.29	1.49	38.32	38.77	5.03
6	18.07	34.85	35.27	41.52	10.06	37	0.25	1.45	38.32	38.77	5.02
7	18.86	35.27	35.70	41.52	10.03	38	0.27	1.48	37.88	39.22	5.03
8	19.51	35.70	35.70	41.99	10.02	39	0.28	1.48	37.44	38.77	5.03
9	19.64	36.13	35.70	41.99	10.08	40	0.29	1.49	37.44	38.77	5.04
10	19.14	36.13	36.13	41.99	10.00	41	0.27	1.46	37.00	38.32	5.04
11	20.20	36.57	36.13	41.99	10.10	42	0.24	1.42	36.57	37.88	5.03
12	19.57	36.57	36.57	41.99	10.06	43	0.24	1.41	36.57	37.88	5.06
13	19.52	20.54	37.00	36.57	10.05	44	0.25	1.42	36.13	37.88	5.04
14	19.88	20.89	37.00	36.57	10.05	45	0.24	1.41	36.13	37.88	5.07
15	20.00	21.01	37.00	36.57	10.10	46	8.54	9.66	36.13	37.88	5.04
16	19.79	20.82	37.00	37.00	10.07	47	24.50	25.53	36.13	37.88	5.04
17	20.40	21.42	37.00	37.00	9.99	48	24.90	25.92	36.13	37.88	5.01
18	21.30	22.32	37.44	37.00	10.05	49	25.90	26.92	36.13	37.88	5.04
19	21.30	22.32	37.44	37.00	10.04	50	26.20	27.22	35.70	37.88	5.02
20	21.70	22.72	37.44	37.00	10.06	51	22.70	23.74	35.70	37.88	5.03
21	22.00	23.03	37.44	37.44	10.02	52	25.00	26.02	35.70	37.88	5.05
22	23.20	24.22	37.44	37.44	10.00	53	16.59	17.66	35.70	37.88	5.04
23	23.30	24.32	37.88	37.44	10.04	54	14.56	15.65	35.70	37.88	5.03
24	24.00	25.02	37.88	37.44	10.09	55	12.60	13.70	35.27	37.88	5.03
25	24.50	25.53	37.88	37.88	10.08	56	14.53	15.60	35.27	37.44	5.01
26	24.60	25.63	37.88	37.88	10.03	57	13.39	14.47	35.27	37.44	5.03
27	24.30	25.33	38.32	37.88	10.00	58	10.95	12.06	35.27	37.88	5.03
28	23.20	24.24	38.32	37.88	10.04						
29	7.69	8.82	38.32	37.88	10.00						
30	0.43	1.62	38.32	38.32	10.10						

DATE:	8/5/02	Summer	Location:	Compost							
Time	7:50 PM		Sample:	6							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	10.31	31.93	32.76	32.76	10.06	31	10.46	11.40	31.93	32.34	5.04
1	10.50	32.34	32.76	32.76	10.09	32	10.74	11.68	32.34	32.34	5.03
2	10.56	32.34	32.76	32.76	10.00	33	10.80	11.74	32.34	32.34	5.03
3	10.71	31.93	32.76	26.34	10.06	34	10.88	11.82	31.93	32.34	5.04
4	10.78	31.93	32.76	26.34	10.02	35	10.91	11.85	31.93	32.34	5.04
5	10.90	31.93	32.76	26.34	10.03	36	11.08	12.02	31.93	32.34	5.02
6	11.07	31.93	32.76	26.34	10.04	37	10.75	11.69	31.93	32.34	5.03
7	11.20	31.93	32.76	26.34	10.08	38	10.56	11.50	31.52	32.34	5.04
8	11.24	31.93	32.76	26.34	10.00	39	10.72	11.66	31.52	32.34	5.03
9	11.33	32.34	32.76	26.34	10.05	40	10.67	11.61	31.52	32.34	5.03
10	11.73	32.34	32.76	26.73	10.01	41	10.48	11.41	31.12	31.93	5.04
11	11.60	32.34	32.76	26.73	10.07	42	10.45	11.38	31.12	31.93	5.01
12	11.71	31.93	32.76	26.73	9.98	43	9.82	10.75	31.52	31.93	5.02
13	11.66	12.59	31.93	32.34	10.06	44	9.17	10.10	31.52	31.93	5.03
14	11.88	12.81	31.93	32.34	10.03	45	9.61	10.55	31.93	32.34	5.04
15	11.90	12.83	31.93	32.34	10.11	46	9.65	10.59	32.34	32.34	5.06
16	12.02	12.95	31.52	32.34	10.00	47	8.31	9.26	32.34	32.34	5.02
17	11.78	12.71	31.52	32.34	0.01	48	0.38	1.39	32.76	32.76	5.03
18	11.05	11.97	31.52	31.93	10.03	49	0.22	1.24	32.76	32.76	5.03
19	11.19	12.11	31.93	31.93	10.05	50	2.66	3.66	32.34	32.76	5.03
20	11.09	12.03	32.34	32.34	10.05	51	2.85	3.86	31.93	33.17	5.03
21	11.07	12.01	32.34	32.34	10.04	52	0.59	1.61	31.93	32.76	5.04
22	11.46	12.39	32.34	32.34	10.12	53	0.61	1.62	31.93	32.76	5.02
23	12.24	13.17	32.76	32.34	10.02	54	2.36	3.36	32.34	32.76	5.04
24	12.05	12.98	32.76	32.34	10.06	55	2.42	3.42	31.93	32.76	5.04
25	12.24	13.17	32.76	32.34	10.10	56	2.23	3.23	31.52	32.76	5.04
26	12.36	13.29	32.34	32.34	10.01						
27	12.01	12.94	32.34	32.34	10.06						
28	11.76	12.69	32.34	32.34	10.07						
29	11.53	12.46	31.93	32.34	10.03						
30	10.97	11.91	31.93	32.34	5.03						

DATE:	8/8/02	Summer	Location:	Free Stall							
Time	1:10 PM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	7.03	31.93	32.76	32.76	10.00	31	18.90	19.79	31.93	32.34	5.06
1	18.20	32.34	32.76	32.76	10.02	32	17.00	17.90	32.34	32.34	5.05
2	15.68	32.34	32.76	32.76	10.06	33	13.30	14.22	32.34	32.34	5.05
3	14.85	31.93	32.76	26.34	10.02	34	12.20	13.13	31.93	32.34	5.04
4	12.55	31.93	32.76	26.34	10.09	35	21.60	22.47	31.93	32.34	5.04
5	10.29	31.93	32.76	26.34	10.08	36	19.79	20.67	31.93	32.34	5.05
6	12.61	31.93	32.76	26.34	9.98	37	16.89	17.79	31.93	32.34	5.06
7	17.00	31.93	32.76	26.34	9.98	38	13.32	14.24	31.52	32.34	5.02
8	15.38	31.93	32.76	26.34	10.07	39	16.42	17.32	31.52	32.34	5.05
9	14.11	32.34	32.76	26.34	10.00	40	19.17	20.06	31.52	32.34	5.03
10	12.71	32.34	32.76	26.73	10.05	41	15.94	16.83	31.12	31.93	5.02
11	11.12	32.34	32.76	26.73	9.98	42	14.06	14.97	31.12	31.93	5.03
12	19.09	31.93	32.76	26.73	10.07	43	22.40	23.26	31.52	31.93	5.04
13	15.96	16.87	31.93	32.34	10.05	44	17.44	18.33	31.52	31.93	5.03
14	11.62	12.55	31.93	32.34	10.06	45	16.06	16.97	31.93	32.34	5.00
15	17.83	18.73	31.93	32.34	10.05	46	14.28	15.20	32.34	32.34	5.03
16	17.70	18.60	31.52	32.34	10.11	47	15.18	16.09	32.34	32.34	5.04
17	14.87	15.78	31.52	32.34	9.99	48	14.52	15.45	32.76	32.76	5.02
18	12.90	13.81	31.52	31.93	10.02	49	14.32	15.25	32.76	32.76	5.05
19	11.64	12.56	31.93	31.93	10.05	50	15.72	16.64	32.34	32.76	5.02
20	14.01	14.93	32.34	32.34	10.08	51	18.17	19.09	31.93	33.17	5.05
21	20.30	21.18	32.34	32.34	10.10	52	16.06	16.98	31.93	32.76	5.08
22	16.52	17.42	32.34	32.34	10.04	53	16.10	17.02	31.93	32.76	5.03
23	14.40	15.32	32.76	32.34	10.02	54	19.15	20.05	32.34	32.76	5.06
24	14.73	15.64	32.76	32.34	10.01	55	16.67	17.59	31.93	32.76	5.05
25	18.60	19.49	32.76	32.34	10.01	56	15.31	16.23	31.52	32.76	5.02
26	15.66	16.57	32.34	32.34	10.09	57	14.41	15.34	31.93	32.76	5.04
27	13.69	14.61	32.34	32.34	10.04	58	8.09	9.06	32.34	32.76	5.04
28	13.58	14.50	32.34	32.34	10.03	59	1.31	2.33	32.34	33.17	5.04
29	11.82	12.75	31.93	32.34	10.05	60	1.09	2.12	32.34	33.17	5.03
30	21.00	21.88	31.93	32.34	10.05						

DATE:	8/8/02	Summer	Location:	Free Stall							
Time	2:18 PM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.94	31.52	32.34	32.76	9.90	31	17.06	17.96	31.93	32.34	5.04
1	0.96	31.93	32.76	32.76	10.04	32	16.17	17.08	31.93	32.34	5.05
2	1.95	32.34	32.76	32.76	10.05	33	15.43	16.34	32.34	32.34	5.03
3	18.19	32.34	32.76	32.76	10.06	34	14.88	15.79	32.34	32.34	5.01
4	19.13	31.93	32.76	26.34	10.04	35	14.50	15.42	31.93	32.34	5.04
5	16.62	31.93	32.76	26.34	10.08	36	14.15	15.07	31.93	32.34	5.04
6	14.84	31.93	32.76	26.34	9.98	37	14.13	15.05	31.93	32.34	5.05
7	13.61	31.93	32.76	26.34	10.05	38	13.99	14.91	31.93	32.34	5.04
8	13.51	31.93	32.76	26.34	10.10	39	13.35	14.27	31.52	32.34	5.03
9	14.88	31.93	32.76	26.34	10.02	40	15.37	16.28	31.52	32.34	5.07
10	15.60	32.34	32.76	26.34	10.10	41	16.22	17.13	31.52	32.34	5.04
11	14.42	32.34	32.76	26.73	10.01	42	16.27	17.16	31.12	31.93	5.04
12	14.08	32.34	32.76	26.73	10.01	43	15.78	16.68	31.12	31.93	5.04
13	13.85	14.78	31.93	32.76	10.03	44	15.17	16.07	31.52	31.93	5.02
14	18.27	19.16	31.93	32.34	10.02	45	14.92	15.82	31.52	31.93	5.04
15	18.49	19.38	31.93	32.34	10.08	46	14.69	15.60	31.93	32.34	5.05
16	16.86	17.76	31.93	32.34	10.05	47	14.39	15.31	32.34	32.34	5.05
17	19.44	20.33	31.52	32.34	10.09	48	13.87	14.79	32.34	32.34	5.04
18	18.77	19.66	31.52	32.34	10.14	49	13.99	14.92	32.76	32.76	5.04
19	18.30	19.18	31.52	31.93	10.08	50	13.50	14.43	32.76	32.76	5.02
20	17.14	18.03	31.93	31.93	10.05	51	13.15	14.09	32.34	32.76	5.00
21	16.95	17.85	32.34	32.34	10.05	52	12.84	13.79	31.93	33.17	5.04
22	14.98	15.89	32.34	32.34	10.01	53	12.65	13.59	31.93	32.76	5.04
23	13.86	14.78	32.34	32.34	10.06	54	12.61	13.55	31.93	32.76	5.02
24	14.19	15.11	32.76	32.34	9.99	55	15.08	16.01	32.34	32.76	5.01
25	14.08	15.00	32.76	32.34	10.04	56	15.46	16.38	31.93	32.76	5.03
26	15.33	16.24	32.76	32.34	10.09	57	15.24	16.16	31.52	32.76	5.04
27	15.22	16.13	32.34	32.34	10.04	58	14.99	15.92	31.93	32.76	5.03
28	16.09	17.00	32.34	32.34	10.05	59	14.21	15.14	32.34	32.76	5.03
29	14.38	15.30	32.34	32.34	10.07	60	13.72	14.67	32.34	33.17	5.03
30	14.23	15.15	31.93	32.34	5.04						

DATE:	8/8/02	Summer	Location:	Free Stall							
Time	3:30 PM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	7.92	28.31	25.17	24.79	9.96	31	3.42	4.20	28.31	25.95	5.02
1	7.35	28.31	24.79	24.79	9.94	32	3.49	4.29	28.31	26.34	5.03
2	2.54	27.91	24.79	24.79	10.01	33	3.45	4.25	28.31	26.34	5.04
3	6.65	27.52	24.79	24.79	10.04	34	3.34	4.14	28.31	26.34	5.02
4	6.25	27.52	24.79	24.79	10.08	35	3.33	4.13	28.70	26.34	5.01
5	5.94	27.12	24.79	25.17	10.07	36	3.24	4.04	28.31	26.34	5.05
6	5.81	27.12	24.79	25.17	10.09	37	3.23	4.03	28.31	26.34	5.03
7	5.50	27.12	24.79	25.17	10.09	38	3.17	3.97	28.31	26.34	5.04
8	5.38	27.12	24.79	25.17	10.06	39	3.13	3.94	28.31	26.73	5.04
9	5.23	26.73	24.79	25.17	10.05	40	3.06	3.87	28.31	26.73	5.03
10	5.10	26.73	24.79	25.17	10.05	41	3.06	3.87	28.31	26.73	5.04
11	4.95	26.73	24.79	25.17	10.08	42	3.19	3.99	28.31	26.34	5.04
12	4.84	26.73	24.79	25.17	10.04	43	3.09	3.90	27.91	26.73	5.02
13	4.71	5.45	26.73	24.79	10.02	44	2.91	3.71	27.91	26.34	5.01
14	4.50	5.24	26.73	24.79	10.04	45	2.87	3.67	27.91	26.34	5.03
15	4.50	5.25	27.12	25.17	9.99	46	2.79	3.59	27.91	26.34	5.03
16	4.31	5.06	27.12	25.17	10.07	47	2.75	3.55	27.91	26.34	5.05
17	4.24	4.99	27.52	25.17	10.03	48	2.80	3.60	27.91	26.34	5.05
18	4.16	4.92	27.52	25.17	10.09	49	2.78	3.58	27.91	26.34	5.05
19	4.11	4.87	27.91	25.17	10.03	50	2.75	3.56	27.91	26.73	4.99
20	4.05	4.82	27.91	25.56	10.09	51	2.74	3.55	27.91	26.73	5.04
21	4.00	4.77	27.91	25.56	10.02	52	2.73	3.54	27.91	26.73	5.04
22	3.93	4.70	28.31	25.56	10.02	53	2.82	3.63	27.91	26.73	5.03
23	3.90	4.67	28.31	25.56	10.02	54	3.94	4.74	27.91	26.73	5.01
24	3.81	4.58	28.31	25.56	10.02	55	4.02	4.82	27.91	26.73	5.03
25	3.76	4.53	28.31	25.56	10.10	56	3.63	4.44	27.91	26.73	5.05
26	3.69	4.46	28.31	25.56	10.04	57	3.53	4.34	28.31	26.73	5.03
27	3.65	4.42	28.31	25.56	10.00						
28	3.57	4.35	28.31	25.95	10.08						
29	3.55	4.33	28.31	25.95	10.02						
30	3.43	4.21	28.31	25.95	10.02						

DATE:	8/8/02	Summer	Location:	Free Stall							
Time	4:42 PM		Sample:	4							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	3.51	27.12	29.10	26.73	10.05	31	27.00	27.72	28.70	28.31	5.04
1	1.72	27.12	29.50	26.34	10.02	32	27.00	27.72	28.70	28.31	5.04
2	2.88	27.52	29.50	26.34	0.08	33	27.00	27.72	28.70	28.31	5.05
3	25.60	27.91	29.50	26.34	15.00	34	27.00	27.72	28.70	28.31	5.03
4	27.00	28.31	29.50	26.34	9.98	35	27.00	27.72	28.31	28.31	5.03
5	27.00	28.31	29.50	26.34	10.09	36	27.00	27.72	28.31	28.31	5.05
6	27.00	28.31	29.50	26.34	10.06	37	27.00	27.72	28.31	28.31	5.02
7	27.00	28.70	29.50	26.34	10.05	38	27.00	27.72	27.91	28.31	5.05
8	27.00	28.70	29.10	26.34	10.03	39	27.00	27.72	27.91	28.31	5.01
9	27.00	28.70	29.10	26.34	10.03	40	27.00	27.72	28.31	28.31	5.05
10	27.00	29.10	29.10	26.34	10.02	41	27.00	27.72	28.31	28.31	5.02
11	27.00	29.10	29.10	26.34	10.04	42	27.00	27.72	28.31	28.31	5.04
12	27.00	29.10	29.10	26.34	10.02	43	27.00	27.72	28.31	28.31	5.04
13	27.00	27.74	29.10	29.10	9.96	44	27.00	27.72	28.31	28.31	5.05
14	27.00	27.74	29.10	29.10	9.97	45	27.00	27.72	27.91	28.31	5.03
15	27.00	27.73	29.10	28.70	10.06	46	27.00	27.72	28.31	28.31	5.04
16	27.00	27.73	29.10	28.70	10.05	47	27.00	27.72	28.31	28.31	5.03
17	27.00	27.73	29.10	28.70	10.06	48	27.00	27.72	28.70	28.31	5.01
18	27.00	27.73	28.70	28.70	10.05	49	27.00	27.72	28.70	28.31	5.03
19	27.00	27.73	28.70	28.70	10.03	50	27.00	27.72	28.70	28.31	5.02
20	27.00	27.73	28.70	28.70	10.12	51	27.00	27.73	28.70	28.70	5.02
21	27.00	27.73	28.70	28.70	10.05	52	27.00	27.73	28.70	28.70	5.02
22	27.00	27.72	28.31	28.31	10.05	53	27.00	27.73	29.10	28.70	5.06
23	27.00	27.72	28.31	28.31	10.12						
24	27.00	27.72	28.31	28.31	10.08						
25	27.00	27.72	28.31	28.31	9.99						
26	27.00	27.72	28.31	28.31	10.07						
27	27.00	27.72	28.31	28.31	10.09						
28	27.00	27.72	28.31	28.31	9.95						
29	27.00	27.72	28.70	28.31	10.07						
30	27.00	27.72	28.70	28.31	5.04						

DATE:	8/8/02	Summer	Location:	Free Stall							
Time	6:05 PM		Sample:	5							
Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC	Zero Air Flow
0	2.03	30.71	25.56	27.12	9.95	31	27.00	27.67	27.52	26.73	5.02
1	1.63	30.31	25.56	27.12	10.00	32	27.00	27.67	27.52	26.73	5.04
2	1.66	29.90	25.56	27.12	10.04	33	27.00	27.67	27.52	26.73	5.04
3	1.57	29.50	25.56	27.12	10.04	34	27.00	27.67	27.52	26.73	5.02
4	1.44	29.10	25.17	26.73	9.98	35	26.90	27.57	27.12	26.73	5.01
5	1.67	29.10	25.56	27.12	0.05	36	27.00	27.67	27.12	26.73	5.03
6	2.50	29.10	25.56	26.73	10.06	37	26.90	27.57	27.12	26.73	5.01
7	27.00	29.10	25.56	27.12	10.07	38	27.00	27.67	27.12	26.73	5.06
8	27.00	29.10	25.56	27.12	10.05	39	27.00	27.67	27.12	26.73	5.01
9	27.00	29.10	25.56	26.73	10.01	40	27.00	27.67	27.12	26.73	5.02
10	27.00	28.70	25.56	26.73	10.04	41	27.00	27.67	27.12	26.73	5.02
11	26.90	28.70	25.56	26.73	10.04	42	27.00	27.67	27.12	26.73	5.04
12	26.90	28.70	25.56	26.73	10.00	43	27.00	27.67	27.12	26.73	5.04
13	26.90	27.54	28.70	25.95	10.00	44	26.90	27.57	27.12	26.73	5.04
14	26.90	27.54	28.70	25.95	10.08	45	27.00	27.67	27.12	26.73	5.08
15	26.90	27.54	28.70	25.95	9.96	46	26.90	27.57	27.12	26.73	5.04
16	26.90	27.54	28.70	25.95	10.03	47	27.00	27.67	27.12	26.73	5.03
17	26.90	27.56	28.31	26.34	10.06	48	27.00	27.67	27.12	26.73	5.03
18	27.00	27.65	28.31	26.34	10.02	49	27.00	27.67	27.12	26.73	5.02
19	26.90	27.56	28.31	26.34	10.03	50	27.00	27.67	27.12	26.73	5.05
20	26.90	27.56	28.31	26.34	10.03	51	27.00	27.67	27.12	26.73	5.04
21	26.90	27.56	28.31	26.34	10.06	52	27.00	27.67	27.12	26.73	5.06
22	26.90	27.56	28.31	26.34	10.05	53	27.00	27.67	27.12	26.73	5.06
23	27.00	27.65	27.91	26.34	9.97						
24	27.00	27.65	27.91	26.34	9.99						
25	27.00	27.65	27.91	26.34	10.04						
26	27.00	27.67	27.91	26.73	10.06						
27	27.00	27.67	27.91	26.73	10.01						
28	27.00	27.67	27.52	26.73	10.00						
29	27.00	27.67	27.52	26.73	10.07						
30	27.00	27.67	27.52	26.73	5.04						

DATE:	8/6/02	Summer	Location:	Lagoon 1							
Time	12:09 AM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	4.06	32.76	31.93	31.12	10.27	31	20.50	21.38	34.01	32.34	4.39
1	4.14	33.17	31.93	31.52	10.00	32	20.30	21.18	34.43	32.34	4.38
2	9.68	33.59	31.93	31.12	10.06	33	19.88	20.76	34.43	32.34	5.04
3	15.14	33.59	31.93	31.12	10.01	34	19.98	20.86	34.43	32.34	5.03
4	16.14	34.01	31.93	31.12	10.06	35	20.10	20.99	34.43	32.76	5.03
5	16.43	34.43	31.93	31.52	10.11	36	20.40	21.29	34.85	32.76	5.03
6	16.79	34.43	31.93	31.93	10.02	37	21.20	22.09	34.85	32.76	5.04
7	16.58	34.85	31.93	31.52	10.08	38	22.20	23.08	34.85	32.76	5.02
8	16.47	34.85	31.93	31.93	10.01	39	22.10	22.98	35.27	32.76	5.04
9	15.96	34.85	31.93	31.52	9.99	40	23.10	23.98	35.27	32.76	5.04
10	15.72	34.85	31.52	31.52	10.04	41	23.20	24.09	35.27	33.17	5.03
11	16.45	34.85	31.52	31.52	10.01	42	25.40	26.28	35.27	33.17	5.03
12	17.80	34.85	31.12	31.12	10.07	43	25.10	25.98	35.70	33.17	5.03
13	17.70	18.56	34.43	31.12	10.05	44	26.10	26.97	35.70	33.17	5.05
14	17.29	18.15	34.43	31.12	10.01	45	26.30	27.17	35.27	33.17	5.04
15	19.39	20.24	34.43	31.12	10.03	46	26.40	27.26	35.27	32.76	5.05
16	19.94	20.79	34.01	31.12	10.05	47	26.80	27.65	34.85	32.76	5.03
17	19.81	20.64	33.59	30.71	10.04	48	26.90	27.75	34.85	32.76	5.03
18	19.60	20.43	33.59	30.71	10.06	49	26.90	27.77	34.43	33.17	5.03
19	21.10	21.94	33.59	31.12	10.01	50	26.40	27.27	34.43	33.17	5.05
20	21.30	22.14	33.59	31.12	10.07	51	26.50	27.37	34.01	33.17	5.04
21	20.60	21.44	34.01	31.12	10.06	52	25.70	26.56	34.43	32.76	5.05
22	20.80	21.64	33.59	31.12	10.09	53	25.20	26.06	34.43	32.76	5.02
23	21.00	21.83	33.59	30.71	9.99	54	25.00	25.87	34.43	32.76	5.04
24	21.60	22.44	33.59	31.12	10.06	55	24.30	25.17	34.43	32.76	5.03
25	22.40	23.23	33.59	31.12	10.08	56	25.30	26.16	34.85	32.76	5.04
26	23.40	24.22	33.59	31.12	9.97						
27	24.50	25.32	33.59	31.12	10.08						
28	24.90	25.73	33.59	31.52	10.05						
29	23.60	24.45	33.59	31.93	10.00						
30	22.10	22.96	34.01	31.93	10.07						

DATE:	8/6/02	Summer	Location:	Lagoon 1							
Time	2:22 PM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	4.73	36.13	32.34	30.31	10.03	31	15.60	16.53	35.70	33.17	5.03
1	5.34	36.13	31.93	30.31	10.02	32	15.49	16.39	35.27	31.93	5.04
2	0.74	35.70	31.93	30.31	10.04	33	16.27	17.15	35.27	31.52	5.06
3	0.57	35.70	32.76	30.71	10.02	34	16.83	17.69	34.85	31.12	5.05
4	1.14	36.13	32.76	31.12	10.03	35	16.82	17.68	34.85	31.12	5.03
5	10.67	36.13	31.93	29.90	10.02	36	17.27	18.13	34.43	31.12	5.04
6	11.91	36.13	31.93	29.90	10.02	37	17.94	18.80	34.43	31.12	5.02
7	12.55	35.70	31.93	29.90	10.00	38	17.96	18.83	34.43	31.52	5.05
8	12.82	35.70	31.93	29.90	10.02	39	17.18	18.07	34.43	31.93	5.03
9	13.06	34.85	31.52	29.90	9.99	40	16.32	17.21	34.43	31.93	5.02
10	13.36	34.43	31.52	29.10	10.02	41	16.71	17.60	34.43	31.93	5.04
11	13.22	34.01	31.12	29.10	10.01	42	16.64	17.53	34.43	31.93	5.03
12	12.79	33.59	31.52	29.10	10.03	43	15.46	16.36	34.85	31.93	5.03
13	12.30	13.22	33.59	31.93	10.03	44	15.52	16.42	34.43	31.93	5.03
14	12.36	13.30	34.01	32.76	10.04	45	15.06	15.96	34.43	31.93	5.04
15	11.87	12.81	34.43	32.76	10.04	46	14.52	15.42	34.43	31.93	5.05
16	11.81	12.75	34.43	32.76	10.10	47	14.42	15.32	34.43	31.93	5.03
17	11.47	12.42	34.43	32.76	10.07	48	13.86	14.77	34.43	31.93	5.05
18	11.57	12.52	34.85	32.76	10.08	49	13.64	14.55	34.85	31.93	5.03
19	12.26	13.21	35.27	33.17	10.08	50	14.42	15.32	34.85	31.93	5.04
20	12.33	13.28	35.70	33.17	10.10	51	14.75	15.65	34.85	31.93	5.03
21	12.69	13.64	35.70	33.17	10.11	52	14.50	15.40	34.85	31.93	5.04
22	12.89	13.84	35.70	33.17	10.02	53	11.99	12.92	35.27	32.34	5.02
23	12.97	13.92	36.13	33.17	10.07	54	12.11	13.04	35.27	32.34	5.03
24	13.07	14.02	36.13	33.17	10.06	55	11.03	11.98	35.70	32.76	5.05
25	13.92	14.88	36.57	33.59	10.04	56	9.52	10.48	36.13	32.76	5.03
26	14.25	15.21	36.57	33.59	10.08	57	8.66	9.62	36.57	32.76	5.03
27	14.40	15.34	36.57	33.17	10.08	58	8.22	9.19	37.00	32.76	5.03
28	14.87	15.81	36.57	33.17	10.05	59	7.84	8.81	37.00	32.76	5.02
29	15.22	16.16	36.57	33.17	10.08	60	7.68	8.66	37.44	33.17	5.02
30	15.56	16.51	36.13	33.59	5.04						

DATE:	8/6/02	Summer	Location:	Lagoon 1							
Time	4:21 PM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.84	33.59	33.59	30.31	10.01	31	15.33	16.28	37.00	33.59	5.04
1	0.95	34.01	33.17	29.50	10.04	32	11.52	12.49	37.00	33.59	5.02
2	1.49	34.01	33.17	29.50	10.03	33	12.58	13.55	36.57	33.59	5.05
3	6.33	34.85	33.17	31.12	10.06	34	11.65	12.62	36.57	33.59	5.03
4	9.26	35.70	33.17	32.76	10.08	35	11.24	12.21	36.13	33.59	5.04
5	10.13	37.00	33.17	33.59	10.11	36	14.74	15.68	36.13	33.17	5.05
6	11.44	37.44	32.76	32.76	10.06	37	12.12	13.08	36.13	33.17	5.04
7	13.91	37.44	32.76	33.17	10.03	38	14.85	15.79	35.70	33.17	5.04
8	13.45	37.00	32.76	34.01	10.05	39	12.99	13.94	35.70	33.17	5.04
9	13.70	37.44	32.76	34.01	10.08	40	12.08	13.02	35.70	32.76	5.04
10	14.91	37.88	32.34	32.76	10.00	41	10.33	11.28	35.70	32.76	5.05
11	15.97	37.44	32.34	31.93	10.05	42	9.08	10.04	35.70	32.76	5.03
12	15.63	37.00	32.34	32.34	10.05	43	7.00	7.97	35.27	32.76	5.04
13	14.33	15.26	37.00	32.76	10.05	44	1.59	2.59	35.27	32.76	5.04
14	15.02	15.95	37.00	32.76	10.02	45	1.83	2.83	35.27	32.76	5.03
15	13.73	14.65	37.44	32.34	10.08	46	1.87	2.88	35.27	32.76	5.05
16	12.09	13.02	38.77	32.34	9.99	47	7.22	8.19	35.70	32.76	5.03
17	11.50	12.45	39.67	32.76	10.10	48	11.72	12.67	36.13	32.76	0.08
18	8.89	9.85	40.13	32.76	10.11	49	11.59	12.54	37.00	32.76	5.05
19	10.63	11.59	38.77	33.17	10.03	50	12.15	13.11	37.44	33.17	5.05
20	11.25	12.21	37.88	33.17	10.08	51	12.22	13.17	37.88	33.17	5.05
21	11.39	12.36	37.44	33.59	9.98	52	13.09	14.04	38.32	33.17	5.05
22	17.26	18.21	37.00	34.01	10.02	53	12.99	13.94	38.32	33.17	5.03
23	12.44	13.42	37.00	34.01	10.05	54	12.81	13.76	38.77	33.17	5.04
24	16.81	17.75	36.57	33.59	10.04	55	13.20	14.16	39.22	33.59	5.03
25	12.46	13.43	36.57	33.59	10.04	56	12.78	13.74	39.22	33.59	5.03
26	10.24	11.22	36.57	33.59	10.05						
27	11.43	12.39	36.57	33.17	10.04						
28	12.78	13.74	36.57	33.59	10.01						
29	12.64	13.61	36.57	33.59	10.04						
30	17.81	18.74	36.57	33.59	5.03						

DATE:	8/6/02	Summer	Location:	Lagoon 1							
Time	5:56 PM		Sample:	4							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.267	31.93	31.52	32.34	10.17	31	10.22	11.16122	37.44	32.34	5.06
1	1.75	32.34	31.52	31.52	10.01	32	10.81	11.7607	37.88	32.76	5.04
2	9.71	32.34	31.52	31.93	9.99	33	11.07	12.01914	37.88	32.76	5.04
3	10.76	32.76	31.52	31.52	10.00	34	11.23	12.17818	37.88	32.76	5.04
4	9.81	32.76	31.52	31.52	10.02	35	11.05	11.99926	37.88	32.76	5.06
5	10	32.76	31.52	31.93	9.98	36	10.84	11.79052	37.88	32.76	5.01
6	11.2	33.17	31.52	32.34	10.04	37	10.36	11.3134	37.44	32.76	5.04
7	11.25	34.01	31.93	33.59	10.05	38	10.17	11.12454	37.44	32.76	5.01
8	11.35	35.27	31.93	34.43	10.06	39	9.94	10.89592	37	32.76	5.03
9	11.46	36.13	31.93	34.43	10.02	40	9.98	10.93568	36.57	32.76	5.05
10	11.27	36.57	31.93	34.43	10.08	41	9.84	10.79652	36.57	32.76	5.05
11	11.28	36.13	31.93	33.17	10.00	42	9.49	10.44862	37	32.76	5.04
12	11.59	35.7	31.93	33.17	10.02	43	9.54	10.49832	37	32.76	5.02
13	11.44	12.36119	35.27	31.93	10.08	44	9.39	10.34922	37	32.76	5.04
14	11.56	12.48047	34.85	31.93	10.07	45	9.21	10.1703	36.57	32.76	5.01
15	11.89	12.80849	34.85	31.93	10.03	46	8.16	9.1266	36.57	32.76	5.02
16	11.88	12.79855	34.43	31.93	10.04	47	9.04	10.00132	36.57	32.76	5.04
17	11.85	12.76873	34.85	31.93	9.97	48	8.73	9.69318	36.57	32.76	5.02
18	11.67	12.58981	35.27	31.93	10.05	49	8.72	9.68324	37	32.76	5.04
19	11.54	12.46059	35.7	31.93	10.06	50	8.42	9.38504	37	32.76	5.05
20	11.43	12.35125	35.7	31.93	10.03	51	7.84	8.80852	37	32.76	5.04
21	11.18	12.10275	36.57	31.93	10.01	52	8.31	9.2757	37	32.76	5.03
22	11.12	12.04311	37.0	31.93	10.09	53	8.02	8.98744	37	32.76	5.04
23	11.04	11.96359	37.0	31.93	10.06	54	7.93	8.89798	37	32.76	5.06
24	10.95	11.88684	37.0	32.34	10.11	55	7.8	8.76876	37	32.76	5.04
25	11.2	12.13534	37.0	32.34	10.04	56	7.8	8.76876	37	32.76	5.04
26	11.23	12.16516	37.44	32.34	10.07						
27	11.27	12.20492	37.44	32.34	10.09						
28	10.95	11.88684	37.44	32.34	10.07						
29	11.06	11.99618	37.44	32.34	10.04						
30	10.92	11.85702	37.44	32.34	5.03						

DATE:	8/6/02	Summer	Location:	Lagoon 1							
Time	7:23 PM		Sample:	5							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	11.61	30.71	31.12	22.09	10.08	31	15.08	15.94	29.90	30.71	4.98
1	11.91	30.71	31.12	22.09	10.01	32	13.88	14.75	29.90	30.71	5.04
2	12.09	31.12	31.12	22.09	10.05	33	13.61	14.48	29.90	30.71	5.03
3	12.65	31.12	30.71	22.48	10.07	34	13.41	14.28	29.90	30.71	5.02
4	12.65	31.12	30.71	22.86	10.07	35	11.90	12.78	29.90	30.71	5.05
5	12.58	30.71	30.71	22.48	10.03	36	9.42	10.32	29.90	30.71	5.07
6	11.51	30.71	30.71	23.63	10.06	37	10.22	11.11	29.90	30.71	5.05
7	11.85	30.31	30.71	24.40	9.99	38	13.88	14.75	29.90	30.71	4.98
8	11.83	30.31	30.71	24.79	10.02	39	11.56	12.44	29.90	30.71	5.05
9	12.28	30.31	30.71	25.17	10.08	40	17.87	18.71	29.90	30.71	5.06
10	12.26	30.31	30.71	25.56	10.06	41	19.25	20.09	29.90	30.71	5.05
11	12.01	29.90	30.71	26.34	10.09	42	19.23	20.07	29.50	30.71	5.07
12	11.28	29.90	30.31	26.73	10.03	43	18.65	19.49	29.50	30.71	5.03
13	11.35	12.22	29.90	30.31	10.01	44	19.74	20.57	29.50	30.71	5.07
14	11.04	11.93	29.90	30.71	10.05	45	19.25	20.07	29.50	30.31	5.01
15	12.20	13.08	30.31	30.71	10.11	46	18.73	19.56	29.50	30.31	5.05
16	13.27	14.14	30.31	30.71	10.07	47	18.27	19.10	29.50	30.31	5.02
17	12.47	13.35	30.31	30.71	10.10	48	19.52	20.34	29.50	30.31	5.02
18	12.10	12.98	30.31	30.71	10.04	49	19.43	20.25	29.50	30.31	5.03
19	10.55	11.44	30.31	30.71	10.06						
20	9.48	10.38	30.31	30.71	10.07						
21	8.42	9.32	30.31	30.71	10.07						
22	7.45	8.36	30.31	30.71	10.05						
23	7.78	8.69	30.31	30.71	10.06						
24	11.83	12.71	30.31	30.71	10.06						
25	14.70	15.56	30.31	30.71	10.06						
26	13.44	14.31	30.31	30.71	10.14						
27	12.19	13.07	30.31	30.71	10.01						
28	11.81	12.69	30.31	30.71	10.08						
29	8.88	9.78	30.31	30.71	10.05						
30	11.38	12.26	29.90	30.71	5.01						

DATE:	8/7/02	Summer	Location:	Lagoon 2							
Time	7:42 AM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.24	22.48	21.33	20.57	10.01	31	19.75	20.41	26.73	25.17	5.02
1	0.24	22.09	20.95	20.95	10.04	32	19.81	20.47	27.12	25.17	5.03
2	0.70	22.09	20.95	20.57	10.06	33	20.10	20.77	27.12	25.56	5.02
3	6.05	21.71	20.95	20.57	10.00	34	19.99	20.66	27.12	25.56	5.03
4	6.46	21.71	20.95	20.95	10.04	35	19.66	20.33	27.12	25.56	5.01
5	9.12	21.71	20.95	20.57	10.06	36	20.60	21.28	27.52	25.95	5.04
6	11.87	21.33	20.95	20.95	10.01	37	21.40	22.08	27.52	25.95	5.05
7	13.58	21.33	21.33	21.33	10.02	38	21.40	22.08	27.91	25.95	5.03
8	15.04	21.33	21.33	21.33	10.06	39	21.70	22.39	27.91	26.34	5.03
9	15.75	21.71	21.33	21.33	10.06	40	21.90	22.59	28.31	26.34	5.03
10	16.85	22.09	21.33	21.33	10.04	41	22.00	22.68	28.31	26.34	5.05
11	17.12	22.09	21.33	21.33	9.99	42	21.80	22.49	28.70	26.34	5.02
12	17.33	22.48	21.33	21.33	10.01	43	22.20	22.88	28.70	26.34	5.02
13	17.61	18.18	22.48	21.71	10.01	44	21.80	22.49	29.10	26.34	5.05
14	17.85	18.43	22.48	22.09	10.09	45	21.00	21.70	29.10	26.73	5.01
15	17.93	18.51	23.24	22.09	10.06	46	20.30	21.01	29.50	26.73	5.03
16	18.43	19.00	23.63	22.09	10.05	47	19.81	20.52	29.50	26.73	5.01
17	18.02	18.62	23.63	22.86	10.00	48	20.10	20.81	29.90	26.73	5.03
18	18.60	19.21	24.01	23.24	10.02	49	20.40	21.12	29.90	27.12	5.04
19	18.94	19.55	24.40	23.24	10.04	50	20.10	20.82	30.31	27.12	5.03
20	18.55	19.16	24.40	23.24	9.99	51	21.00	21.71	30.31	27.12	5.03
21	18.24	18.86	24.79	23.63	10.06	52	19.79	20.51	30.71	27.12	5.02
22	18.36	18.98	25.17	23.63	10.02	53	21.00	21.73	30.71	27.52	5.05
23	18.49	19.11	25.17	23.63	10.01	54	20.70	21.43	30.71	27.52	5.06
24	18.45	19.07	25.56	23.63	10.06	55	21.40	22.12	31.12	27.52	5.02
25	18.72	19.36	25.95	24.40	10.05	56	21.40	22.12	31.12	27.52	5.03
26	19.10	19.75	25.95	24.79	10.07	57	22.10	22.82	31.12	27.52	5.03
27	19.28	19.94	26.34	25.17	10.08	58	22.10	22.83	31.52	27.91	5.01
28	19.46	20.12	26.34	25.17	10.06	59	22.90	23.63	31.52	27.91	5.04
29	19.38	20.04	26.73	25.17	10.04	60	22.90	23.63	31.52	27.91	5.04
30	19.58	20.24	26.73	25.17	5.03						

DATE:	8/7/02	Summer	Location:	Lagoon 2							
Time	9:03 AM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.00	29.10	27.12	26.73	10.04	31	6.45	7.34	37.00	29.90	5.03
1	0.00	29.50	27.12	26.73	10.03	32	6.52	7.41	37.00	29.90	5.03
2	0.00	29.90	26.73	26.73	10.01	33	6.36	7.25	37.44	29.90	5.03
3	13.02	30.31	26.73	24.79	10.03	34	5.98	6.88	37.44	30.31	5.04
4	10.62	30.71	27.12	24.79	10.00	35	6.02	6.92	37.88	30.31	5.03
5	9.31	31.52	26.73	25.17	10.04	36	5.92	6.82	37.88	30.31	5.09
6	10.66	32.34	27.52	25.17	10.07	37	5.50	6.41	37.88	30.31	5.04
7	10.31	32.76	28.31	25.56	10.00	38	7.21	8.11	37.44	30.31	5.04
8	8.64	32.76	28.70	26.34	10.10	39	8.24	9.14	37.44	30.71	5.04
9	8.03	33.17	29.10	26.34	10.02	40	6.88	7.79	37.44	30.71	5.05
10	8.54	33.59	29.10	26.34	10.08	41	6.40	7.31	37.00	30.71	5.03
11	7.72	33.59	29.10	26.34	10.03	42	5.99	6.91	37.00	30.71	5.05
12	10.05	34.01	29.10	26.34	10.01	43	6.61	7.52	37.00	30.71	5.03
13	8.88	9.73	34.01	29.10	10.06	44	5.32	6.24	37.00	30.71	5.03
14	8.47	9.32	34.43	29.10	10.04	45	5.34	6.26	37.00	30.71	5.04
15	8.01	8.86	34.43	29.10	10.04	46	5.72	6.64	37.44	30.71	5.03
16	6.76	7.62	34.85	29.10	10.00	47	5.11	6.03	37.44	30.71	5.03
17	8.02	8.87	34.85	29.10	10.04	48	5.14	6.06	37.88	30.71	5.10
18	8.36	9.21	34.85	29.10	10.01	49	5.92	6.84	37.88	30.71	5.02
19	8.76	9.61	35.27	29.10	10.04	50	5.08	6.00	37.88	30.71	5.03
20	8.36	9.21	35.27	29.10	10.03	51	5.23	6.15	37.88	30.71	5.04
21	7.76	8.62	35.27	29.10	10.10	52	5.29	6.21	38.32	30.71	5.04
22	7.13	7.99	35.27	29.10	10.01	53	5.63	6.56	38.32	31.12	5.03
23	6.42	7.28	35.70	29.10	9.98	54	5.35	6.28	38.32	31.12	5.03
24	7.54	8.41	35.70	29.50	10.07						
25	6.84	7.71	36.13	29.50	10.08						
26	6.12	7.00	36.57	29.50	10.03						
27	5.91	6.79	36.57	29.50	10.02						
28	6.49	7.37	37.00	29.50	10.00						
29	6.68	7.57	37.00	29.90	10.07						
30	6.37	7.26	37.00	29.90	5.04						

DATE:	8/7/02	Summer	Location:	Lagoon 2							
Time	10:22 AM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.71	33.49	29.32	26.54	9.96	31	27.00	27.83	40.21	31.96	5.03
1	0.86	34.14	29.53	29.33	9.99	32	27.00	27.83	40.70	31.96	5.02
2	5.20	34.56	30.37	30.37	10.04	33	27.00	27.83	40.92	31.96	5.01
3	5.90	35.92	30.16	29.40	10.05	34	27.00	27.83	40.19	32.16	5.06
4	6.75	35.65	30.15	29.82	10.04	35	27.00	27.83	40.41	32.16	5.01
5	6.13	35.37	29.75	29.80	10.02	36	27.00	27.83	40.65	32.16	5.04
6	5.25	35.33	30.14	29.59	9.99	37	27.00	27.83	40.17	32.16	5.02
7	4.79	35.54	30.33	29.58	10.09	38	27.00	27.83	40.19	32.16	5.04
8	4.11	35.54	30.73	29.55	10.09	39	27.00	27.84	39.72	32.36	5.02
9	1.90	35.53	30.93	29.14	15.00	40	27.00	27.84	39.72	32.36	5.03
10	2.90	35.74	30.93	29.14	10.04	41	27.00	27.83	38.57	32.15	5.03
11	5.97	35.74	30.93	29.34	10.13	42	27.00	27.83	37.89	32.15	5.01
12	27.00	35.51	30.72	28.93	10.02	43	27.00	27.83	37.22	32.15	5.03
13	27.00	27.78	34.86	30.52	10.04	44	27.00	27.83	36.35	31.94	5.01
14	27.00	27.78	34.85	30.52	10.00	45	27.00	27.83	36.14	31.94	5.04
15	27.00	27.79	35.28	30.72	10.02	46	27.00	27.82	36.15	31.74	5.03
16	27.00	27.79	35.49	30.72	10.03	47	27.00	27.82	36.15	31.74	5.02
17	27.00	27.78	35.28	30.52	10.05	48	27.00	27.82	37.01	31.74	5.06
18	27.00	27.79	35.28	30.72	10.05	49	27.00	27.82	37.88	31.74	5.06
19	27.00	27.80	37.02	31.14	10.11	50	27.00	27.82	38.33	31.74	5.05
20	27.00	27.81	38.16	31.35	10.05	51	27.00	27.82	38.78	31.74	5.01
21	27.00	27.82	39.11	31.56	10.02	52	27.00	27.82	38.55	31.74	5.05
22	27.00	27.82	39.11	31.56	9.97	53	27.00	27.83	39.23	32.15	5.05
23	27.00	27.82	38.85	31.56	10.02	54	27.00	27.83	39.69	32.15	5.02
24	27.00	27.82	39.32	31.76	10.01	55	27.00	27.83	39.69	32.15	5.04
25	27.00	27.82	39.06	31.76	10.02	56	27.00	27.83	39.69	32.15	5.05
26	27.00	27.82	39.05	31.76	10.00						
27	27.00	27.82	39.52	31.76	10.04						
28	27.00	27.82	39.73	31.76	10.08						
29	27.00	27.83	39.97	31.96	10.04						
30	27.00	27.83	39.97	31.96	5.03						

DATE:	8/7/02	Summer	Location:	Lagoon 2							
Time	11:56 AM		Sample:	4							
Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient ^oC	Temp Chamber ^oC	Temp Ground ^oC	Zero Air Flow
0	0.82	37.88	31.52	26.34	10.05	31	27.00	27.89	43.42	34.01	5.03
1	4.32	38.77	31.93	31.93	10.05	32	27.00	27.89	44.40	34.01	5.04
2	24.60	39.22	34.01	34.01	10.03	33	27.00	27.89	44.40	34.01	5.04
3	27.00	41.52	33.59	34.01	9.98	34	27.00	27.89	42.94	34.01	5.02
4	27.00	40.59	33.17	34.85	10.03	35	27.00	27.89	42.94	34.01	5.06
5	27.00	39.22	32.76	34.43	10.06	36	27.00	27.89	43.42	34.01	5.05
6	27.00	38.32	32.76	34.01	10.03	37	27.00	27.89	42.46	34.01	5.04
7	27.00	38.32	32.34	33.59	10.07	38	27.00	27.89	42.94	34.01	5.04
8	27.00	38.32	32.76	32.76	10.03	39	27.00	27.89	41.99	34.01	5.05
9	27.00	37.88	32.76	31.93	10.02	40	27.00	27.89	41.99	34.01	5.02
10	27.00	37.88	32.76	31.93	9.98	41	27.00	27.88	40.13	33.59	5.02
11	27.00	37.88	32.76	32.34	10.01	42	27.00	27.88	38.77	33.59	0.00
12	27.00	37.00	32.34	31.52	10.07	43	27.00	27.88	37.44	33.59	5.03
13	27.00	27.83	35.70	31.93	10.06	44	27.00	27.87	35.70	33.17	5.03
14	27.00	27.83	35.27	31.93	10.02	45	27.00	27.87	35.27	33.17	5.03
15	27.00	27.84	36.13	32.34	10.00	46	27.00	27.85	34.85	32.76	5.04
16	27.00	27.84	36.13	32.34	10.00	47	27.00	27.85	34.85	32.76	5.04
17	27.00	27.83	35.70	31.93	10.00	48	27.00	27.85	36.13	32.76	5.05
18	27.00	27.84	35.70	32.34	10.06	49	27.00	27.85	37.88	32.76	5.03
19	27.00	27.87	38.77	33.17	10.07	50	27.00	27.85	38.77	32.76	5.02
20	27.00	27.88	41.05	33.59	10.00	51	27.00	27.85	39.67	32.76	5.04
21	27.00	27.89	42.94	34.01	10.01	52	27.00	27.85	38.77	32.76	5.05
22	27.00	27.89	42.94	34.01	10.05	53	27.00	27.87	40.13	33.17	5.03
23	27.00	27.89	41.99	34.01	9.94	54	27.00	27.87	41.05	33.17	5.03
24	27.00	27.89	42.94	34.01	10.03	55	27.00	27.87	41.99	33.17	5.04
25	27.00	27.89	41.99	34.01	10.03						
26	27.00	27.89	41.52	34.01	10.00						
27	27.00	27.89	42.46	34.01	10.09						
28	27.00	27.89	42.46	34.01	10.02						
29	27.00	27.89	42.94	34.01	10.01						
30	27.00	27.89	42.94	34.01	5.03						

DATE:	8/7/02	Summer	Location:	Mixing Tank							
Time	1:54 PM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.73	37.00	44.89	23.24	10.03	31	22.30	23.27	51.22	35.70	5.03
1	0.68	40.59	43.91	14.47	9.99	32	21.50	22.48	51.79	35.70	5.03
2	0.67	41.99	42.46	14.09	10.05	33	21.00	21.98	52.37	35.70	5.08
3	0.67	42.94	41.99	12.93	9.99	34	20.70	21.67	52.95	35.27	5.01
4	0.80	45.89	41.99	13.32	10.07	35	20.80	21.77	53.53	35.27	5.03
5	0.82	47.96	39.67	12.93	10.06	36	22.00	22.96	53.53	35.27	5.02
6	0.73	49.02	38.32	12.16	10.03	37	23.50	24.44	54.13	34.85	5.06
7	0.72	50.11	38.32	10.99	10.06	38	26.30	27.22	54.13	34.85	5.01
8	0.71	50.66	41.05	11.77	10.04	39	26.80	27.72	54.74	34.85	5.05
9	0.68	51.79	39.67	9.82	10.06	40	26.90	27.82	54.74	34.85	5.03
10	0.64	50.11	38.32	2.89	10.10	41	26.90	27.82	54.13	34.85	5.01
11	0.63	50.66	38.32	12.93	10.10	42	26.90	27.82	52.95	34.85	5.03
12	0.59	51.22	38.32	10.99	10.07	43	26.90	27.82	52.95	34.85	5.06
13	0.59	1.77	50.11	38.32	10.01	44	26.90	27.82	53.53	34.85	5.02
14	0.62	1.77	47.96	37.00	10.06	45	27.00	27.91	52.95	34.43	4.99
15	0.65	1.77	46.40	36.13	10.12	46	27.00	27.91	52.95	34.43	5.04
16	0.65	1.77	45.39	36.57	10.09	47	27.00	27.91	53.53	34.43	5.05
17	0.65	1.77	44.89	36.13	10.03	48	27.00	27.91	52.95	34.43	5.02
18	0.65	1.77	44.40	36.13	10.01	49	26.90	27.81	52.95	34.43	5.02
19	0.65	1.78	43.91	36.57	10.05	50	24.80	25.72	52.37	34.43	5.05
20	17.26	18.32	44.40	37.44	10.04	51	23.70	24.63	52.37	34.43	5.04
21	27.00	27.97	45.89	36.57	10.02	52	22.70	23.62	51.79	34.01	5.04
22	27.00	27.94	46.40	35.70	10.06	53	23.00	23.93	52.37	34.43	5.04
23	27.00	27.94	45.39	35.70	9.99	54	23.50	24.43	52.95	34.43	5.02
24	27.00	27.97	44.40	36.57	10.05	55	23.80	24.72	52.95	34.43	5.04
25	27.00	27.99	43.42	37.00	10.10	56	23.60	24.51	51.22	34.01	5.01
26	27.00	27.99	42.46	37.00	10.10	57	24.00	24.92	49.56	34.43	5.04
27	27.00	27.97	44.40	36.57	10.06	58	24.90	25.82	47.96	34.43	5.03
28	26.70	27.66	46.40	36.13	10.04	59	26.10	27.01	48.49	34.43	5.04
29	24.90	25.87	47.96	36.13	10.08	60	26.90	27.82	50.11	34.85	5.04
30	23.50	24.47	49.56	35.70	5.06						

DATE:	8/7/02	Summer	Location:	Mixing Tank							
Time	2:59 PM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	17.64	51.22	36.57	e	10.08	31	0.73	1.77	41.52	33.59	5.06
1	21.20	50.11	36.13	e	9.98	32	0.67	1.72	42.94	34.01	5.04
2	23.30	49.02	35.70	e	10.09	33	0.68	1.73	44.40	34.01	5.02
3	25.10	48.49	35.27	e	e	34	0.77	1.81	45.89	34.01	5.04
4	26.50	49.56	35.27	e	e	35	0.68	1.73	46.91	34.01	5.04
5	26.80	50.11	35.27	e	e	36	0.63	1.69	47.96	34.43	5.02
6	26.70	50.66	34.85	e	e	37	0.62	1.70	48.49	34.85	5.04
7	26.80	50.66	34.85	e	e	38	0.65	1.74	49.02	35.27	5.06
8	26.80	51.22	34.85	e	e	39	0.67	1.77	49.56	35.70	5.05
9	26.80	50.66	34.85	e	e	40	0.68	1.78	49.56	35.70	5.04
10	26.80	51.22	34.85	e	e	41	0.68	1.79	50.11	36.13	5.02
11	26.30	51.22	34.85	e	10.06	42	0.66	1.78	50.66	36.13	5.03
12	18.53	50.66	34.85	e	10.06	43	0.65	1.77	51.22	36.13	5.04
13	1.71	2.78	51.22	34.85	10.06	44	0.64	1.76	51.79	36.13	5.02
14	1.34	2.41	50.11	34.85	9.99	45	0.64	1.77	52.37	36.57	5.06
15	0.99	2.07	49.56	34.85	10.05	46	0.75	1.87	52.37	36.57	5.03
16	0.87	1.94	49.56	34.85	9.99	47	0.68	1.81	52.95	36.57	5.07
17	0.81	1.88	50.66	34.85	10.09	48	0.63	1.75	52.95	36.13	5.06
18	0.82	1.89	51.79	34.85	10.03	49	0.61	1.74	52.95	36.57	5.05
19	0.77	1.86	52.37	35.27	10.13	50	0.59	1.73	54.13	37.00	5.04
20	0.76	1.85	51.79	35.27	10.03	51	0.58	1.74	54.74	37.44	4.99
21	0.73	1.82	51.79	35.27	10.04	52	0.56	1.73	54.74	37.88	5.06
22	0.70	1.79	51.22	35.27	10.06	53	0.53	1.70	54.74	37.88	5.05
23	0.80	1.88	51.79	35.27	10.04	54	0.54	1.69	54.13	37.00	5.05
24	0.85	1.94	52.95	35.27	9.99	55	0.57	1.71	51.22	37.00	5.05
25	0.91	2.00	53.53	35.27	10.00	56	0.56	1.70	46.40	37.00	5.05
26	0.86	1.93	51.79	34.85	10.06	57	0.54	1.69	44.89	37.00	5.02
27	0.94	2.01	49.02	34.85	10.01	58	0.71	1.86	43.42	37.00	5.04
28	0.81	1.87	46.40	34.43	10.03	59	1.05	2.19	42.46	37.00	5.04
29	0.78	1.83	44.40	34.01	10.00	60	1.60	2.73	41.52	37.00	5.04
30	0.73	1.78	42.94	34.01	5.02						

DATE:	8/7/02	Summer	Location:	Open Lot							
Time	4:56 PM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.21	33.17	36.57	27.91	10.09	31	14.16	15.29	31.93	39.22	5.03
1	1.48	32.76	37.88	26.34	10.09	32	14.22	15.35	31.93	39.22	5.04
2	1.48	32.76	38.32	25.95	10.04	33	14.35	15.48	31.93	39.22	5.02
3	1.25	32.76	38.32	25.56	10.04	34	14.38	15.51	31.52	39.22	5.05
4	1.13	32.34	38.77	25.56	9.96	35	14.46	15.59	31.52	39.22	5.01
5	1.06	32.34	38.77	25.56	10.04	36	14.50	15.63	31.52	39.22	5.04
6	1.34	32.34	38.77	25.56	10.01	37	14.54	15.67	31.52	39.22	5.03
7	1.57	32.34	38.77	25.56	10.03	38	14.62	15.75	31.52	39.22	5.03
8	1.41	32.34	38.77	25.56	10.08	39	14.66	15.80	31.52	39.67	5.03
9	1.28	32.76	38.32	25.56	10.03	40	14.74	15.88	31.52	39.67	5.03
10	1.16	32.76	37.88	25.56	10.02	41	14.90	16.04	31.52	39.67	5.03
11	1.04	32.76	37.88	25.56	9.95	42	15.26	16.40	31.52	39.67	5.02
12	7.24	32.76	37.88	25.56	10.05	43	15.75	16.90	31.12	40.13	5.02
13	8.10	9.23	32.76	37.88	10.00	44	15.83	16.98	31.52	40.13	5.03
14	8.58	9.70	32.34	37.88	10.00	45	15.98	17.13	31.12	40.13	5.04
15	9.14	10.26	32.34	37.88	10.00	46	16.02	17.17	31.12	40.13	5.03
16	9.98	11.11	32.34	38.32	10.04	47	16.02	17.17	31.12	40.13	5.02
17	10.67	11.81	32.34	38.77	10.01	48	16.15	17.30	31.12	40.13	5.02
18	10.20	11.37	32.76	39.67	10.04	49	16.15	17.31	31.12	40.59	5.02
19	9.00	10.19	32.76	40.13	10.05	50	16.32	17.48	31.12	40.59	5.03
20	9.37	10.57	32.76	40.59	10.04	51	16.18	17.34	31.12	40.59	5.01
21	9.94	11.14	32.76	40.59	10.06	52	16.38	17.54	31.12	40.59	5.04
22	10.50	11.67	32.76	39.67	10.08	53	16.48	17.64	31.12	40.59	5.04
23	11.45	12.60	32.76	39.22	10.03	54	16.64	17.80	31.12	40.59	5.03
24	12.41	13.55	32.34	39.22	10.09	55	16.73	17.89	31.12	40.59	5.01
25	12.89	14.01	32.34	38.77	10.07	56	16.73	17.89	31.12	40.59	5.05
26	13.29	14.41	32.34	38.77	10.07	57	16.72	17.88	31.12	40.59	5.01
27	13.44	14.56	31.93	38.77	10.02	58	16.72	17.88	31.12	40.59	5.02
28	13.68	14.81	31.93	39.22	5.05	59	16.73	17.89	31.12	40.59	5.02
29	13.76	14.89	31.93	39.22	5.07	60	16.79	17.95	31.12	40.59	5.02
30	13.92	15.05	31.93	39.22	5.05						

DATE:	8/7/02	Summer	Location:	Open Lot							
Time	6:10 PM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	26.80	34.01	38.77	27.91	10.05	31	26.60	27.55	35.27	35.70	5.04
1	26.80	34.43	38.32	27.91	10.04	32	26.60	27.55	35.27	35.70	5.05
2	26.80	34.85	38.32	27.91	9.97	33	26.60	27.55	35.27	35.70	5.04
3	26.80	35.27	37.88	27.91	10.06	34	26.60	27.55	35.27	35.70	5.04
4	26.70	35.70	37.88	27.91	10.04	35	26.60	27.55	35.27	35.70	5.02
5	26.70	35.70	37.88	27.91	10.00	36	26.60	27.55	35.27	35.70	5.03
6	26.70	36.13	37.44	27.91	10.01	37	26.60	27.55	35.27	35.70	5.05
7	26.70	36.13	37.44	27.91	10.03	38	26.60	27.55	35.27	35.70	5.03
8	26.70	36.13	37.44	27.91	10.04	39	26.60	27.55	35.27	35.70	5.03
9	26.70	36.13	37.00	27.91	10.00	40	26.60	27.55	35.27	35.70	5.03
10	26.70	36.13	37.00	27.91	10.00	41	26.60	27.55	35.27	35.70	5.03
11	26.70	36.13	37.00	27.91	10.02	42	26.60	27.53	34.85	35.27	5.03
12	26.70	36.13	37.00	27.91	10.05	43	26.60	27.55	34.85	35.70	5.02
13	26.70	27.67	36.13	36.57	10.03	44	26.60	27.53	34.85	35.27	5.03
14	26.70	27.67	36.13	36.57	10.00	45	26.60	27.53	34.85	35.27	5.03
15	26.70	27.67	36.13	36.57	10.05	46	26.60	27.53	34.85	35.27	5.03
16	26.70	27.67	36.13	36.57	10.06	47	26.60	27.53	34.85	35.27	5.04
17	26.70	27.67	36.13	36.57	10.04	48	26.60	27.53	34.85	35.27	5.03
18	26.70	27.66	36.13	36.13	10.07	49	26.60	27.53	34.85	35.27	5.02
19	26.70	27.66	36.13	36.13	10.01	50	26.60	27.53	34.85	35.27	5.03
20	26.70	27.66	36.13	36.13	10.10	51	26.60	27.53	34.85	35.27	5.05
21	26.60	27.56	36.13	36.13	10.03	52	26.60	27.53	34.85	35.27	5.03
22	26.60	27.56	36.13	36.13	10.02						
23	26.60	27.55	36.13	35.70	10.06						
24	26.60	27.55	35.70	35.70	10.04						
25	26.60	27.55	35.70	35.70	10.04						
26	26.60	27.55	35.70	35.70	10.01						
27	26.60	27.53	35.70	35.27	10.11						
28	26.60	27.53	35.70	35.27	10.00						
29	26.60	27.55	35.70	35.70	9.99						
30	26.60	27.55	35.70	35.70	5.04						

DATE:	8/8/02	Summer	Location:	Open Lot							
Time	7:34 AM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.62	25.56	23.63	26.34	8.57	31	26.96	27.57	25.56	24.79	5.05
1	1.62	25.56	23.63	26.34	9.59	32	26.96	27.57	25.56	24.79	5.01
2	1.59	25.56	23.63	26.34	2.00	33	26.95	27.56	25.56	24.79	5.01
3	26.97	25.56	24.01	26.34	2.54	34	26.96	27.58	25.56	25.17	5.03
4	26.97	25.56	24.01	26.34	5.68	35	26.96	27.58	25.56	25.17	5.03
5	26.96	25.17	24.01	26.34	1.45	36	26.95	27.57	25.56	25.17	5.06
6	26.96	25.17	24.01	26.34	10.32	37	26.95	27.57	25.56	25.17	5.04
7	26.96	25.17	24.01	26.34	1.61	38	26.96	27.58	25.56	25.17	5.02
8	26.95	25.17	24.01	26.34	1.44	39	26.95	27.57	25.56	25.17	5.03
9	26.95	25.17	24.40	26.34	0.04	40	26.95	27.57	25.56	25.17	5.03
10	26.96	25.17	24.40	26.34	0.04	41	26.95	27.57	25.56	25.17	5.06
11	26.96	25.17	24.40	26.34	0.10	42	26.94	27.56	25.56	25.17	5.06
12	26.27	25.17	24.40	26.34	10.01	43	26.95	27.57	25.95	25.17	5.03
13	3.47	4.21	25.17	24.40	10.06	44	26.95	27.58	25.95	25.56	5.04
14	2.70	3.44	25.17	24.40	10.04	45	26.96	27.59	25.95	25.56	5.03
15	12.25	12.94	25.17	24.40	10.07	46	26.95	27.58	25.95	25.56	5.04
16	26.95	27.55	25.17	24.40	10.04	47	26.96	27.59	25.95	25.56	5.04
17	26.95	27.55	25.17	24.40	10.03	48	26.96	27.59	25.95	25.56	5.05
18	26.95	27.55	25.17	24.40	9.99	49	26.96	27.59	25.95	25.56	5.03
19	26.95	27.55	25.17	24.40	10.05	50	26.96	27.59	25.95	25.56	5.03
20	26.96	27.55	25.17	24.40	10.04	51	26.95	27.58	25.95	25.56	5.06
21	26.96	27.55	25.17	24.40	10.03	52	26.96	27.60	25.95	25.95	5.04
22	26.96	27.55	25.17	24.40	10.03	53	26.95	27.60	26.34	25.95	5.06
23	26.96	27.55	25.17	24.40	10.00	54	26.96	27.60	26.34	25.95	4.99
24	26.96	27.56	25.17	24.79	10.06	55	26.95	27.59	26.34	25.95	5.04
25	26.95	27.56	25.56	24.79	10.04						
26	26.96	27.56	25.56	24.79	10.08						
27	26.96	27.57	25.56	24.79	10.07						
28	26.96	27.56	25.56	24.79	10.04						
29	26.96	27.56	25.56	24.79	10.07						
30	26.96	27.57	25.56	24.79	5.03						

DATE:	8/8/02	Summer	Location:	Open Lot							
Time	8:40 AM		Sample:	4							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	2.26	25.95	26.73	26.73	9.96	31	17.30	18.07	27.12	28.31	5.02
1	10.55	25.95	26.73	26.73	10.01	32	17.42	18.19	27.12	28.31	5.02
2	27.00	25.95	26.73	26.73	10.03	33	18.32	19.09	27.12	28.31	5.03
3	27.00	25.95	26.73	26.73	9.98	34	18.30	19.07	27.12	28.31	5.05
4	27.00	25.95	26.73	26.73	10.00	35	18.23	19.00	27.12	28.31	5.02
5	27.00	25.95	26.73	26.73	10.04	36	18.09	18.86	27.52	28.31	5.03
6	27.00	25.95	27.12	26.73	10.06	37	18.45	19.23	27.52	28.70	5.04
7	27.00	26.34	27.12	26.73	10.03	38	17.46	18.24	27.52	28.70	5.04
8	27.00	26.34	27.12	26.73	10.03	39	18.27	19.05	27.52	28.70	5.05
9	26.70	26.34	27.12	26.73	10.05	40	18.64	19.42	27.52	28.70	5.02
10	24.10	26.34	27.12	26.73	10.01	41	18.70	19.49	27.52	29.10	5.04
11	23.90	26.34	27.12	26.73	10.00	42	17.71	18.51	27.52	29.10	5.02
12	22.80	26.34	27.12	26.73	10.03	43	18.71	19.50	27.91	29.10	5.03
13	22.10	22.81	26.34	27.12	10.08	44	24.50	25.26	27.91	29.10	5.03
14	21.80	22.51	26.34	27.12	10.03	45	24.50	25.27	27.91	29.50	5.05
15	21.00	21.71	26.34	27.12	10.04	46	25.90	26.66	27.91	29.50	5.01
16	20.40	21.13	26.34	27.52	10.07	47	24.80	25.57	27.91	29.50	5.07
17	21.00	21.73	26.34	27.52	10.03	48	23.80	24.57	27.91	29.50	5.01
18	21.40	22.12	26.34	27.52	10.04	49	24.10	24.87	27.91	29.50	5.00
19	19.98	20.71	26.34	27.52	10.04	50	24.90	25.67	27.91	29.50	5.01
20	19.86	20.59	26.34	27.52	10.05	51	24.60	25.37	28.31	29.50	5.00
21	19.23	19.97	26.34	27.52	10.00	52	23.90	24.68	28.31	29.90	5.04
22	19.50	20.24	26.73	27.52	10.09						
23	18.79	19.54	26.73	27.91	10.04						
24	20.10	20.84	26.73	27.91	10.00						
25	19.65	20.40	26.73	27.91	10.03						
26	18.47	19.22	26.73	27.91	10.08						
27	18.53	19.28	26.73	27.91	10.07						
28	18.62	19.37	26.73	27.91	10.07						
29	17.92	18.68	26.73	27.91	10.02						
30	18.08	18.85	27.12	28.31	5.04						

DATE:	8/8/02	Summer	Location:	Open Lot							
Time	9:46 AM		Sample:	5							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	2.47	29.10	31.93	27.91	10.13	31	10.79	11.85	35.70	36.13	5.03
1	18.99	29.50	31.52	28.31	10.04	32	11.20	12.25	35.27	36.13	5.04
2	18.26	29.90	31.52	28.70	10.03	33	11.46	12.52	35.70	36.57	5.01
3	15.90	29.90	31.52	28.70	10.07	34	11.55	12.61	35.70	36.57	5.03
4	14.72	30.31	31.52	28.70	10.01	35	11.49	12.55	35.70	36.57	5.04
5	13.87	30.71	31.52	28.70	10.04	36	11.65	12.71	35.70	36.57	5.04
6	12.96	30.71	31.93	29.10	10.03	37	11.69	12.75	35.70	36.57	5.06
7	12.45	31.12	31.93	29.10	10.08	38	11.81	12.89	35.70	37.00	5.03
8	11.68	31.52	32.34	29.10	10.02	39	12.04	13.11	35.70	37.00	5.05
9	12.40	31.52	32.76	29.10	10.05	40	11.89	12.97	35.70	37.00	5.05
10	12.21	31.93	32.76	29.10	10.04	41	11.77	12.85	35.70	37.00	5.04
11	11.65	31.93	32.76	29.10	10.12	42	11.78	12.86	35.27	37.00	5.05
12	11.69	31.93	32.76	29.10	10.03	43	11.78	12.86	35.27	37.00	5.04
13	11.23	12.18	31.93	32.76	10.07	44	11.85	12.93	35.27	37.00	5.03
14	10.73	11.69	32.34	33.17	10.04	45	11.89	12.97	35.27	37.00	5.04
15	11.29	12.25	32.76	33.17	10.09	46	11.81	12.89	35.27	37.00	5.02
16	11.56	12.53	32.76	33.59	10.03	47	11.76	12.84	35.27	37.00	5.02
17	11.63	12.61	32.76	34.01	10.06	48	11.50	12.58	34.85	37.00	5.03
18	11.58	12.56	33.17	34.01	10.12	49	11.59	12.67	34.85	37.00	5.02
19	11.22	12.21	33.17	34.01	10.02	50	11.57	12.65	34.85	37.00	5.01
20	11.16	12.16	33.59	34.43	10.05	51	11.55	12.63	34.85	37.00	5.05
21	11.15	12.15	33.59	34.43	10.02	52	11.42	12.50	34.85	37.00	5.04
22	11.01	12.02	34.01	34.85	10.07	53	11.38	12.46	34.85	37.00	5.02
23	11.22	12.23	34.43	34.85	10.07	54	11.41	12.49	34.85	37.00	5.02
24	10.81	11.83	34.85	34.85	10.07	55	11.68	12.76	34.85	37.00	5.05
25	10.54	11.57	34.85	35.27	10.10	56	11.68	12.76	34.85	37.00	5.04
26	10.59	11.62	35.27	35.27	10.01	57	11.78	12.86	34.85	37.00	5.02
27	10.82	11.86	35.70	35.70	9.98	58	11.74	12.82	35.27	37.00	5.04
28	11.10	12.14	35.70	35.70	10.04	59	11.74	12.83	35.27	37.44	5.02
29	11.19	12.23	35.70	35.70	10.07	60	11.74	12.83	35.27	37.44	5.02
30	10.96	12.01	35.70	36.13	5.06						

DATE:	8/8/02	Summer	Location:	Open Lot							
Time	10:52 AM		Sample:	6							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.05	29.50	31.52	28.31	10.16	31	18.19	19.20	35.27	36.13	5.03
1	1.02	29.90	31.52	28.70	9.95	32	18.25	19.27	35.70	36.57	5.03
2	10.21	29.90	31.52	28.70	10.06	33	18.81	19.83	35.70	36.57	5.05
3	13.75	30.31	31.52	28.70	10.01	34	18.05	19.08	35.70	36.57	5.03
4	17.58	30.71	31.52	28.70	10.03	35	17.48	18.51	35.70	36.57	4.98
5	19.60	30.71	31.93	29.10	10.06	36	16.86	17.89	35.70	36.57	4.99
6	21.60	31.12	31.93	29.10	10.11	37	16.73	17.78	35.70	37.00	5.04
7	23.30	31.52	32.34	29.10	10.07	38	15.96	17.01	35.70	37.00	5.03
8	24.00	31.52	32.76	29.10	10.04	39	16.11	17.16	35.70	37.00	5.07
9	24.40	31.93	32.76	29.10	10.01	40	16.96	18.01	35.70	37.00	5.03
10	25.00	31.93	32.76	29.10	10.04	41	15.85	16.90	35.27	37.00	5.05
11	26.10	31.93	32.76	29.10	10.03	42	16.54	17.59	35.27	37.00	5.06
12	24.70	31.93	32.76	29.10	10.11	43	16.07	17.12	35.27	37.00	5.05
13	21.00	21.90	32.34	33.17	10.11	44	15.46	16.51	35.27	37.00	5.04
14	19.70	20.61	32.76	33.17	10.05	45	15.79	16.84	35.27	37.00	5.03
15	19.17	20.10	32.76	33.59	10.00	46	15.04	16.10	35.27	37.00	5.06
16	17.03	17.98	32.76	34.01	10.03	47	15.36	16.41	34.85	37.00	5.01
17	15.68	16.64	33.17	34.01	10.01	48	14.60	15.66	34.85	37.00	5.02
18	14.18	15.15	33.17	34.01	10.02	49	15.40	16.45	34.85	37.00	5.02
19	12.45	13.44	33.59	34.43	10.04	50	14.23	15.29	34.85	37.00	5.00
20	8.05	9.07	33.59	34.43	10.07	51	14.42	15.48	34.85	37.00	5.06
21	20.60	21.56	34.01	34.85	10.04	52	14.65	15.71	34.85	37.00	5.05
22	22.50	23.45	34.43	34.85	10.02	53	15.15	16.21	34.85	37.00	5.04
23	23.10	24.04	34.85	34.85	10.04	54	14.43	15.49	34.85	37.00	5.03
24	23.40	24.35	34.85	35.27	10.05	55	15.18	16.24	34.85	37.00	5.04
25	22.40	23.36	35.27	35.27	10.04	56	14.32	15.38	34.85	37.00	5.04
26	22.10	23.07	35.70	35.70	10.04	57	14.50	15.56	35.27	37.00	5.02
27	21.50	22.48	35.70	35.70	10.03	58	15.04	16.11	35.27	37.44	5.04
28	20.60	21.58	35.70	35.70	10.03	59	13.90	14.98	35.27	37.44	5.04
29	19.95	20.95	35.70	36.13	5.03	60	13.45	14.53	35.27	37.44	5.04
30	19.57	20.57	35.70	36.13	5.04						

DATE:	8/5/02	Summer	Location:	Separated Solids							
Time	3:54 PM		Sample:	1							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.94	35.27	37.44	58.55	10.06	31	0.41	1.77	45.39	43.91	5.05
1	0.83	35.70	37.88	59.22	10.05	32	0.37	1.73	45.39	43.91	5.05
2	0.69	36.57	38.32	59.22	10.07	33	0.34	1.70	44.89	43.91	5.03
3	0.69	37.00	38.77	59.90	10.03	34	4.79	6.12	44.89	43.91	5.03
4	0.80	37.88	39.22	59.90	10.06	35	26.90	28.10	44.89	43.91	5.03
5	0.66	38.77	39.67	59.90	10.07	36	26.90	28.13	45.89	44.89	5.04
6	0.61	40.13	40.59	59.90	10.02	37	26.90	28.15	46.40	45.39	5.04
7	0.56	41.52	41.05	59.90	10.04	38	26.90	28.16	46.91	45.89	5.04
8	0.55	42.46	41.99	59.90	10.03	39	26.90	28.16	47.43	45.89	5.03
9	0.54	43.42	41.99	59.90	10.06	40	26.90	28.18	47.43	46.40	5.04
10	0.47	44.40	42.46	59.90	10.09	41	26.90	28.18	47.43	46.40	5.01
11	0.43	44.89	42.94	59.90	10.00	42	26.90	28.19	47.96	46.91	5.02
12	0.46	45.89	43.42	59.90	10.05	43	26.90	28.21	48.49	47.43	5.05
13	0.51	1.87	46.40	43.91	10.04	44	26.50	27.81	48.49	47.43	5.05
14	0.47	1.83	46.40	43.91	10.07	45	25.90	27.23	49.02	47.96	5.06
15	0.42	1.78	46.91	43.91	10.03	46	25.80	27.13	48.49	47.96	5.05
16	0.46	1.81	46.40	43.42	10.10	47	23.70	25.01	47.43	46.91	5.02
17	0.60	1.93	45.89	42.94	10.03	48	23.50	24.78	46.40	45.89	5.04
18	0.63	1.94	45.39	42.46	10.01	49	23.50	24.78	45.89	45.89	5.03
19	0.53	1.84	45.39	42.46	10.03	50	22.80	24.07	45.39	45.39	5.04
20	0.46	1.77	44.89	42.46	10.04	51	21.40	22.66	44.40	44.89	5.04
21	0.43	1.74	44.89	42.46	10.03	52	21.30	22.56	43.91	44.89	5.03
22	0.58	1.89	44.40	42.46	10.09	53	20.40	21.67	43.91	44.89	5.05
23	0.66	1.96	43.91	41.99	10.04	54	18.67	19.93	43.42	44.40	5.04
24	0.61	1.91	43.91	41.99	10.02	55	18.06	19.33	42.94	44.40	5.03
25	0.72	2.01	43.42	41.99	10.04	56	17.72	18.99	42.94	44.40	5.05
26	0.65	1.95	43.42	41.99	10.08	57	17.40	18.66	42.46	43.91	5.04
27	0.53	1.83	43.42	41.99	10.11	58	15.69	16.96	42.46	43.91	5.03
28	0.53	1.84	43.91	42.46	10.00	59	5.19	6.52	41.99	43.91	5.03
29	0.46	1.79	44.40	42.94	10.08						
30	0.44	1.80	44.89	43.91	5.04						

DATE:	8/6/02	Summer	Location:	Separated Solids							
Time	7:59 AM		Sample:	2							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.68	29.50	25.95	40.59	10.02	31	22.50	23.21	27.91	27.12	5.04
1	1.74	28.70	25.56	40.59	10.01	32	22.50	23.21	27.91	27.12	5.05
2	3.03	27.91	25.56	41.05	10.09	33	22.60	23.31	28.31	27.12	5.04
3	4.03	27.12	25.56	41.05	10.07	34	22.70	23.40	28.31	27.12	5.03
4	4.89	26.73	25.56	41.05	10.00	35	22.80	23.50	28.31	27.12	5.02
5	5.78	26.73	25.56	41.05	10.04	36	22.90	23.62	28.31	27.52	5.03
6	6.39	26.34	25.17	40.59	10.02	37	22.90	23.62	28.31	27.52	5.04
7	7.52	26.34	29.10	40.59	10.03	38	22.70	23.42	28.31	27.52	5.01
8	13.33	26.73	28.31	40.59	10.07	39	22.60	23.32	28.31	27.52	5.04
9	15.45	26.73	28.31	37.00	10.01	40	22.30	23.02	28.31	27.52	5.03
10	13.75	25.95	28.31	25.56	10.04	41	22.40	23.12	28.31	27.52	5.04
11	10.70	25.56	28.31	37.00	10.04	42	22.20	22.93	28.70	27.91	5.04
12	12.84	25.17	25.56	41.99	10.03	43	22.30	23.03	28.70	27.91	5.03
13	14.02	14.73	25.17	25.56	10.07	44	21.10	21.84	29.10	27.91	5.04
14	14.94	15.65	25.17	25.95	10.05	45	20.40	21.14	29.10	27.91	5.03
15	15.70	16.42	25.17	26.34	9.99	46	19.71	20.46	29.50	27.91	5.04
16	16.29	17.01	25.17	26.34	10.02	47	18.93	19.69	29.50	28.31	5.04
17	16.92	17.64	25.56	26.34	9.99	48	19.01	19.77	29.50	28.31	5.05
18	17.32	18.03	25.95	26.34	10.02	49	18.83	19.59	29.90	28.31	5.04
19	17.80	18.51	26.34	26.34	10.02	50	18.68	19.45	29.90	28.31	5.03
20	18.48	19.19	26.34	26.34	10.05	51	18.86	19.62	29.90	28.31	5.03
21	18.83	19.55	26.73	26.73	9.94	52	18.82	19.60	30.31	28.70	5.04
22	19.25	19.98	27.12	27.12	10.00	53	18.65	19.43	30.31	28.70	5.03
23	20.30	21.03	27.12	27.52	10.02	54	18.67	19.45	30.31	28.70	5.03
24	20.70	21.43	27.12	27.52	10.03	55	18.42	19.20	30.71	28.70	5.02
25	21.00	21.71	27.12	27.12	10.08	56	18.40	19.19	30.71	29.10	5.05
26	21.20	21.90	27.12	26.73	10.04	57	17.83	18.63	31.12	29.10	5.05
27	21.30	22.00	27.12	26.73	10.02	58	17.94	18.73	31.12	29.10	5.02
28	21.40	22.10	27.12	26.73	10.06	59	17.92	18.71	31.12	29.10	5.02
29	21.90	22.60	27.52	26.73	5.04	60	17.92	18.71	31.52	29.10	5.00
30	21.90	22.60	27.52	26.73	5.03						

DATE:	8/6/02	Summer	Location:	Separated Solids							
Time	9:28 AM		Sample:	3							
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.32	29.10	31.12	27.52	10.04	31	27.00	27.87	33.59	33.17	5.03
1	0.39	29.10	31.12	27.52	10.05	32	27.00	27.88	34.01	33.59	5.02
2	1.09	29.50	31.12	27.52	10.09	33	27.00	27.89	34.43	34.01	5.04
3	14.64	29.50	30.71	27.52	10.04	34	27.00	27.89	34.43	34.01	5.02
4	27.00	29.50	30.71	27.52	10.03	35	27.00	27.89	34.85	34.01	5.03
5	27.00	29.50	30.71	27.52	10.09	36	27.00	27.91	35.27	34.43	5.05
6	27.00	29.50	31.12	27.52	15.00	37	27.00	27.91	35.27	34.43	5.03
7	27.00	29.50	31.12	27.52	10.01	38	27.00	27.91	34.85	34.43	5.04
8	27.00	29.50	31.12	27.52	10.05	39	27.00	27.92	34.85	34.85	5.03
9	27.00	29.50	31.12	27.52	10.01	40	27.00	27.92	35.27	34.85	5.01
10	27.00	29.50	31.12	27.52	10.05	41	27.00	27.92	35.70	34.85	5.05
11	27.00	29.50	31.12	27.52	10.03	42	27.00	27.93	36.13	35.27	5.04
12	27.00	29.10	31.12	27.52	10.05	43	27.00	27.93	36.13	35.27	5.05
13	27.00	27.80	29.10	31.12	10.06	44	27.00	27.93	36.57	35.27	5.04
14	27.00	27.80	29.50	31.12	10.03	45	27.00	27.93	37.00	35.27	5.03
15	27.00	27.80	29.90	31.12	10.08	46	27.00	27.94	37.44	35.70	5.04
16	27.00	27.80	30.31	31.12	10.02	47	27.00	27.94	37.44	35.70	5.02
17	27.00	27.80	30.71	31.12	10.07	48	27.00	27.94	37.88	35.70	5.03
18	27.00	27.82	30.71	31.52	10.01	49	27.00	27.94	38.32	35.70	5.02
19	27.00	27.82	31.12	31.52	10.07	50	27.00	27.96	38.77	36.13	5.04
20	27.00	27.82	31.12	31.52	10.04						
21	27.00	27.82	31.12	31.52	10.09						
22	27.00	27.82	31.52	31.52	10.12						
23	27.00	27.82	31.93	31.52	10.03						
24	27.00	27.83	31.93	31.93	10.04						
25	27.00	27.83	32.34	31.93	10.06						
26	27.00	27.83	32.34	31.93	10.04						
27	27.00	27.83	32.76	31.93	10.09						
28	27.00	27.83	32.76	31.93	10.02						
29	27.00	27.83	32.76	31.93	10.09						
30	27.00	27.85	33.17	32.76	5.03						

DATE:	1/17/03 1:24 PM	Winter	Location:	Compost	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.08	19.74	3.25	4.53	9.17	30	6.31	10.25	1.17	18.66	5.43
1	2.05	17.73	1.71	7.66	10.01	31	5.09	10.78	1.17	18.66	5.02
2	3.01	15.27	1.60	9.36	10.01	32	6.28	10.99	1.17	18.66	5.02
3	2.47	14.19	1.60	12.32	9.98	33	6.82	10.74	1.17	18.82	5.02
4	2.87	13.28	1.60	14.41	10.04	34	6.67	10.53	1.17	18.66	5.02
5	2.54	12.76	1.60	15.23	9.99	35	6.73	10.21	1.17	18.57	5.03
6	3.48	12.27	1.60	15.26	10.00	36	6.60	10.21	1.17	18.31	5.02
7	3.61	11.59	1.42	15.23	10.01	37	6.47	10.21	1.17	18.41	5.02
8	3.66	11.17	1.42	15.23	10.02	38	6.20	10.21	1.17	18.28	5.02
9	3.33	10.03	1.35	15.36	10.03	39	6.24	10.46	1.17	18.28	5.02
10	3.57	9.82	1.35	15.62	10.02	40	6.50	10.60	1.17	18.28	5.02
11	3.94	9.71	1.39	15.68	10.01	41	6.46	10.99	1.17	18.28	5.02
12	4.48	9.82	1.42	16.00	10.01	42	6.32	11.38	1.17	18.31	5.02
13	4.77	9.82	1.35	16.32	10.00	43	6.32	11.38	1.17	18.60	5.02
14	4.86	9.93	1.46	16.38	9.99	44	6.30	11.52	1.17	18.66	5.02
15	4.90	10.21	1.46	16.54	10.01	45	6.68	11.34	1.17	18.69	5.02
16	5.20	10.60	1.35	16.76	10.00	46	5.95	10.81	1.17	19.04	5.01
17	5.62	10.64	1.28	17.01	10.00	47	4.49	10.74	1.17	19.04	5.02
18	5.73	10.71	1.31	17.14	10.01	48	7.46	10.99	1.17	19.04	5.02
19	5.67	10.99	1.21	17.14	10.02	49	7.75	10.99	1.17	19.04	5.02
20	5.60	10.99	1.17	17.27	9.99	50	8.03	10.53	1.17	17.05	5.02
21	5.34	10.60	1.21	17.14	10.01	51	8.11	9.60	1.17	14.57	5.02
22	5.19	10.21	1.21	17.14	10.03	52	7.72	9.21	1.17	13.45	5.02
23	4.60	10.21	1.28	17.36	10.00	53	7.31	9.03	1.17	12.93	5.02
24	4.10	10.21	1.17	17.52	10.00	54	6.71	9.03	1.17	12.55	5.01
25	5.13	10.32	1.17	17.52	10.01	55	6.63	9.03	1.17	12.36	5.02
26	3.91	10.67	1.17	17.52	10.00	56	6.80	9.23	2.74	12.74	5.03
27	4.19	10.99	1.17	17.52	9.98	57	7.53	e	e	e	5.02
28	4.89	10.74	1.17	18.00	10.01	58	6.01	e	e	e	5.01
29	4.28	10.60	1.17	18.50	9.99	59	7.15	e	e	e	5.02

DATE:	1/17/03 2:26 PM	Winter	Location:	Compost	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.20	10.92	20.54	10.25	9.17	30	18.95	6.62	39.90	14.09	5.43
1	6.57	10.28	35.85	11.22	10.02	31	20.38	6.62	39.67	14.09	5.02
2	11.38	9.67	37.26	12.13	10.02	32	20.63	6.62	40.09	14.09	5.02
3	12.08	9.21	37.44	12.55	10.00	33	21.50	6.62	40.28	14.09	5.02
4	12.83	9.03	37.44	12.55	9.99	34	21.00	6.62	40.25	14.25	5.02
5	13.15	8.63	37.44	12.55	9.98	35	21.52	6.62	40.59	14.47	5.02
6	13.62	8.63	37.44	12.58	10.02	36	22.20	6.62	40.97	14.47	5.02
7	13.76	8.27	37.95	12.68	10.01	37	22.70	6.26	41.05	14.47	5.02
8	14.03	7.47	38.40	12.77	9.98	38	22.62	6.22	41.05	14.47	5.02
9	14.54	7.03	38.32	12.93	10.01	39	23.15	6.26	40.74	14.47	5.02
10	14.88	7.03	38.43	12.93	10.00	40	19.25	6.22	41.05	14.47	5.02
11	14.88	6.69	38.77	12.93	10.02	41	15.86	6.22	40.86	14.47	5.02
12	15.34	6.62	38.77	12.93	10.02	42	19.51	6.22	40.59	14.47	5.02
13	15.74	6.62	38.77	12.93	10.02	43	23.73	6.62	40.59	14.50	5.02
14	15.97	6.62	38.62	12.93	10.00	44	23.47	6.62	40.55	14.82	5.02
15	16.28	6.62	38.88	12.93	10.02	45	23.87	6.62	40.36	14.85	5.02
16	16.03	6.62	38.77	12.93	9.99	46	23.01	6.62	40.51	14.85	5.02
17	16.27	6.62	38.73	12.93	10.00	47	23.40	6.62	40.25	14.85	5.02
18	17.04	6.62	38.77	12.93	10.03	48	23.92	7.03	40.13	14.82	5.02
19	15.14	6.51	39.37	12.93	10.01	49	23.87	7.03	40.13	14.85	5.02
20	14.57	6.62	39.22	12.93	10.02	50	17.05	7.03	40.02	14.85	5.02
21	17.96	6.47	39.26	12.93	10.00	51	23.39	7.14	39.67	14.85	5.02
22	13.49	6.22	39.30	12.93	10.00	52	24.44	7.43	39.67	14.57	5.02
23	17.90	6.44	39.67	13.29	10.00	53	20.07	7.61	39.67	14.47	5.02
24	18.80	6.62	39.26	13.29	10.00	54	13.05	7.83	39.67	14.79	5.03
25	19.22	6.69	38.77	13.32	10.00	55	16.20	7.58	40.02	14.79	5.02
26	19.35	7.03	38.85	13.32	10.01	56	12.73	7.78	31.56	12.73	5.02
27	19.63	7.03	38.85	13.32	9.99	57	23.80	e	e	e	5.02
28	19.19	6.81	38.85	13.48	10.01	58	21.95	e	e	e	5.02
29	13.93	6.92	39.45	13.77	10.00	59	21.94	e	e	e	5.02

DATE:	1/17/03 3:28 PM	Winter	Location:	Compost	Sample	3					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	3.61	15.02	22.94	6.01	9.19	30	24.14	7.03	50.66	14.09	5.11
1	18.58	13.28	49.21	8.96	10.01	31	23.85	7.39	50.66	14.09	5.02
2	17.96	11.38	50.43	10.86	10.00	32	24.95	7.43	50.66	14.44	5.02
3	10.71	10.39	50.66	11.84	10.00	33	25.05	7.18	50.66	14.47	5.02
4	9.16	9.75	50.66	12.19	9.99	34	25.58	6.92	50.66	14.47	5.02
5	10.09	9.06	50.66	12.55	10.02	35	26.74	6.62	50.66	14.47	5.02
6	16.77	8.27	50.89	12.55	10.00	36	26.10	6.37	50.66	14.47	5.02
7	18.16	7.79	51.17	12.58	10.00	37	20.27	6.22	50.66	14.57	5.02
8	18.65	7.43	51.13	12.71	10.02	38	18.65	6.22	50.66	14.79	5.02
9	18.75	7.10	50.85	12.87	10.01	39	26.21	6.58	50.66	14.85	5.02
10	19.04	6.99	50.66	12.93	9.97	40	22.64	6.62	50.66	14.85	5.02
11	18.65	6.62	50.66	12.93	10.02	41	21.44	6.37	50.66	14.85	5.02
12	18.18	6.62	51.13	12.93	10.01	42	27.10	6.22	50.66	14.85	5.02
13	19.02	6.44	50.85	12.93	10.01	43	28.15	6.22	50.66	14.85	5.03
14	19.41	6.22	50.66	12.93	10.00	44	27.65	6.22	50.66	14.85	5.02
15	17.80	6.22	50.66	12.93	10.03	45	27.61	6.55	50.66	14.85	5.02
16	19.27	6.22	50.66	12.93	10.02	46	26.89	6.62	50.66	14.98	5.02
17	20.05	6.22	50.66	12.93	10.04	47	27.32	6.99	50.66	15.23	5.02
18	20.41	6.22	50.66	12.93	10.00	48	28.44	7.03	50.66	15.23	5.01
19	19.71	6.62	50.66	13.09	10.00	49	26.90	7.03	50.66	15.23	5.02
20	20.62	6.55	50.66	13.32	9.99	50	20.56	7.03	50.66	15.23	5.03
21	19.47	6.51	50.66	13.32	9.99	51	26.04	7.03	50.66	15.23	5.02
22	21.06	6.55	50.66	13.32	10.02	52	14.61	7.03	50.66	15.23	5.02
23	21.37	6.55	50.66	13.45	10.01	53	24.03	7.03	50.66	15.43	5.02
24	22.26	6.51	50.66	13.70	10.02	54	27.59	7.10	50.66	15.78	5.02
25	22.40	6.22	50.66	13.70	9.98	55	20.57	8.23	36.32	14.97	5.02
26	22.70	6.22	50.66	13.70	10.01	56	25.65	10.92	15.27	12.05	5.02
27	21.82	6.47	50.66	13.70	10.02	57	20.25	e	e	e	5.02
28	21.61	6.84	50.66	13.80	10.03	58	25.60	e	e	e	5.02
29	22.68	7.03	50.66	14.09	10.01	59	25.63	e	e	e	5.02

DATE:	1/18/03 6:33 PM	Winter	Location:	Free Stall	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.48	e	e	e	0.08	30	37.76	e	e	e	10.01
1	3.97	e	e	e	9.99	31	38.72	e	e	e	5.02
2	8.93	e	e	e	10.00	32	36.94	e	e	e	5.02
3	9.15	e	e	e	10.00	33	16.08	e	e	e	5.02
4	7.23	e	e	e	10.01	34	36.07	e	e	e	5.03
5	16.51	e	e	e	10.01	35	33.52	e	e	e	5.02
6	16.57	e	e	e	10.01	36	41.67	e	e	e	5.02
7	17.81	e	e	e	10.02	37	45.43	e	e	e	5.02
8	22.30	e	e	e	10.01	38	46.63	e	e	e	5.02
9	25.60	e	e	e	9.99	39	46.72	e	e	e	5.02
10	22.64	e	e	e	10.02	40	47.81	e	e	e	5.02
11	16.22	e	e	e	9.99	41	47.99	e	e	e	5.02
12	20.98	e	e	e	10.00	42	48.92	e	e	e	5.02
13	25.65	e	e	e	10.00	43	49.11	e	e	e	5.02
14	29.12	e	e	e	10.01	44	45.54	e	e	e	5.02
15	27.02	e	e	e	10.00	45	35.85	e	e	e	5.03
16	23.09	e	e	e	10.00	46	47.89	e	e	e	5.02
17	30.84	e	e	e	10.01	47	51.24	e	e	e	5.02
18	32.41	e	e	e	10.01	48	51.68	e	e	e	5.03
19	31.93	e	e	e	10.03	49	52.50	e	e	e	5.02
20	32.11	e	e	e	10.03	50	49.87	e	e	e	5.03
21	32.72	e	e	e	10.01	51	50.74	e	e	e	5.02
22	34.51	e	e	e	10.00	52	53.37	e	e	e	5.02
23	35.35	e	e	e	10.01	53	49.99	e	e	e	5.03
24	24.68	e	e	e	10.00	54	41.83	e	e	e	5.02
25	16.43	e	e	e	10.01	55	55.23	e	e	e	5.02
26	25.35	e	e	e	10.01	56	55.18	e	e	e	5.02
27	29.06	e	e	e	10.00	57	54.15	e	e	e	5.02
28	15.16	e	e	e	10.01	58	55.48	e	e	e	5.03
29	34.92	e	e	e	10.00	59	56.04	e	e	e	5.02

DATE:	1/18/03 7:40 PM	Winter	Location:	Free Stall	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	14.50	e	e	e	9.99	30	29.16	e	e	e	5.02
1	17.68	e	e	e	10.02	31	29.80	e	e	e	5.02
2	22.73	e	e	e	10.00	32	30.39	e	e	e	5.02
3	24.29	e	e	e	9.99	33	26.89	e	e	e	5.02
4	26.12	e	e	e	10.00	34	25.25	e	e	e	5.03
5	25.95	e	e	e	10.02	35	31.41	e	e	e	5.03
6	27.33	e	e	e	10.00	36	31.73	e	e	e	5.03
7	27.33	e	e	e	10.00	37	32.51	e	e	e	5.02
8	27.98	e	e	e	10.00	38	32.43	e	e	e	5.02
9	27.64	e	e	e	10.01	39	32.84	e	e	e	5.03
10	16.94	e	e	e	10.00	40	28.00	e	e	e	5.02
11	25.69	e	e	e	10.01	41	22.29	e	e	e	5.02
12	29.11	e	e	e	10.01	42	21.87	e	e	e	5.03
13	29.07	e	e	e	10.00	43	26.61	e	e	e	5.03
14	22.38	e	e	e	9.99	44	32.30	e	e	e	5.03
15	28.43	e	e	e	10.01	45	31.40	e	e	e	5.02
16	26.36	e	e	e	10.02	46	32.25	e	e	e	5.03
17	24.42	e	e	e	10.03	47	32.97	e	e	e	5.02
18	30.58	e	e	e	10.02	48	32.05	e	e	e	5.02
19	30.47	e	e	e	10.01	49	32.03	e	e	e	5.03
20	30.78	e	e	e	10.00	50	32.76	e	e	e	5.02
21	29.50	e	e	e	10.02	51	28.52	e	e	e	5.02
22	30.80	e	e	e	10.00	52	26.58	e	e	e	5.03
23	30.78	e	e	e	10.01	53	32.07	e	e	e	5.02
24	30.95	e	e	e	10.02	54	31.57	e	e	e	5.02
25	30.83	e	e	e	10.00	55	32.48	e	e	e	5.03
26	30.37	e	e	e	10.01	56	32.34	e	e	e	5.02
27	28.69	e	e	e	10.00	57	32.14	e	e	e	5.03
28	29.37	e	e	e	10.02	58	32.20	e	e	e	5.02
29	29.33	e	e	e	6.68	59	31.92	e	e	e	2.60

DATE:	1/18/03 8:42 PM	Winter	Location:	Free Stall	Sample	3					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	3.01	e	e	e	9.19	30	51.18	e	e	e	5.43
1	9.41	e	e	e	10.02	31	51.30	e	e	e	5.03
2	20.25	e	e	e	10.00	32	53.05	e	e	e	5.02
3	27.35	e	e	e	10.00	33	42.50	e	e	e	5.02
4	31.25	e	e	e	10.00	34	49.54	e	e	e	5.02
5	27.48	e	e	e	9.99	35	55.65	e	e	e	5.02
6	31.17	e	e	e	10.01	36	56.54	e	e	e	5.02
7	35.97	e	e	e	10.02	37	45.04	e	e	e	5.02
8	28.47	e	e	e	10.00	38	51.04	e	e	e	5.02
9	31.52	e	e	e	10.01	39	55.64	e	e	e	5.02
10	33.46	e	e	e	10.02	40	58.54	e	e	e	5.02
11	30.50	e	e	e	10.02	41	59.13	e	e	e	5.02
12	41.55	e	e	e	10.00	42	59.21	e	e	e	5.02
13	42.43	e	e	e	10.01	43	46.71	e	e	e	5.03
14	41.73	e	e	e	10.01	44	50.97	e	e	e	5.02
15	43.83	e	e	e	10.01	45	60.49	e	e	e	5.02
16	44.92	e	e	e	9.99	46	60.34	e	e	e	5.03
17	43.72	e	e	e	10.00	47	48.21	e	e	e	5.02
18	35.97	e	e	e	10.00	48	54.39	e	e	e	5.02
19	41.24	e	e	e	10.00	49	61.92	e	e	e	5.02
20	47.52	e	e	e	9.99	50	61.56	e	e	e	5.02
21	47.32	e	e	e	9.99	51	59.21	e	e	e	5.03
22	38.00	e	e	e	10.00	52	46.54	e	e	e	5.02
23	32.69	e	e	e	10.02	53	62.92	e	e	e	5.02
24	44.02	e	e	e	10.01	54	62.74	e	e	e	5.03
25	48.82	e	e	e	10.01	55	63.87	e	e	e	5.02
26	39.27	e	e	e	9.99	56	63.52	e	e	e	5.03
27	44.35	e	e	e	10.01	57	64.68	e	e	e	5.02
28	50.58	e	e	e	10.00	58	64.01	e	e	e	5.02
29	50.32	e	e	e	10.01	59	65.02	e	e	e	5.03

DATE:	1/18/03 9:50 PM	Winter	Location:	Free Stall	Sample	4					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	11.59	e	e	e	9.16	30	36.64	e	e	e	5.44
1	10.42	e	e	e	10.02	31	39.01	e	e	e	5.02
2	17.23	e	e	e	10.00	32	39.46	e	e	e	5.02
3	22.03	e	e	e	10.01	33	40.90	e	e	e	5.02
4	26.02	e	e	e	10.01	34	34.29	e	e	e	5.02
5	20.28	e	e	e	10.00	35	33.82	e	e	e	5.02
6	26.40	e	e	e	10.01	36	41.22	e	e	e	5.02
7	26.28	e	e	e	10.01	37	42.42	e	e	e	5.02
8	26.04	e	e	e	10.01	38	36.47	e	e	e	5.02
9	25.83	e	e	e	10.02	39	37.45	e	e	e	5.02
10	22.97	e	e	e	10.00	40	44.41	e	e	e	5.03
11	21.97	e	e	e	10.01	41	44.95	e	e	e	5.02
12	27.38	e	e	e	10.01	42	43.17	e	e	e	5.02
13	20.96	e	e	e	10.00	43	44.51	e	e	e	5.02
14	28.11	e	e	e	10.01	44	44.71	e	e	e	5.03
15	29.14	e	e	e	10.00	45	44.91	e	e	e	5.02
16	29.70	e	e	e	10.01	46	26.82	e	e	e	5.03
17	31.24	e	e	e	10.01	47	45.46	e	e	e	5.03
18	31.93	e	e	e	10.00	48	46.17	e	e	e	5.03
19	32.54	e	e	e	10.01	49	44.46	e	e	e	5.02
20	33.08	e	e	e	9.99	50	46.76	e	e	e	5.03
21	33.63	e	e	e	10.02	51	47.16	e	e	e	5.03
22	33.93	e	e	e	10.02	52	48.88	e	e	e	5.03
23	34.77	e	e	e	9.99	53	48.94	e	e	e	5.02
24	35.07	e	e	e	10.00	54	49.55	e	e	e	5.02
25	35.90	e	e	e	10.00	55	41.32	e	e	e	5.02
26	35.54	e	e	e	9.99	56	42.03	e	e	e	5.02
27	27.28	e	e	e	10.01	57	48.63	e	e	e	5.02
28	35.29	e	e	e	10.00	58	35.60	e	e	e	5.03
29	36.83	e	e	e	10.02	59	47.83	e	e	e	5.02

DATE:	1/19/03 7:35 AM	Winter	Location:	Free Stall	Sample	5					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	5.46	e	e	e	0.23	30	9.64	e	e	e	10.00
1	6.67	e	e	e	0.29	31	9.69	e	e	e	10.01
2	7.09	e	e	e	0.36	32	9.77	e	e	e	9.99
3	7.62	e	e	e	0.40	33	9.52	e	e	e	10.00
4	7.92	e	e	e	0.44	34	6.57	e	e	e	10.02
5	8.45	e	e	e	0.47	35	7.81	e	e	e	10.02
6	8.71	e	e	e	9.98	36	8.86	e	e	e	6.67
7	8.60	e	e	e	10.02	37	5.09	e	e	e	5.02
8	8.04	e	e	e	10.01	38	8.78	e	e	e	5.02
9	7.72	e	e	e	10.01	39	9.56	e	e	e	5.02
10	7.90	e	e	e	10.00	40	8.33	e	e	e	5.02
11	8.00	e	e	e	10.00	41	8.26	e	e	e	5.02
12	8.02	e	e	e	10.02	42	4.96	e	e	e	5.02
13	7.80	e	e	e	10.02	43	8.99	e	e	e	5.02
14	7.89	e	e	e	10.00	44	1.97	e	e	e	5.02
15	8.16	e	e	e	10.00	45	3.44	e	e	e	5.03
16	7.51	e	e	e	10.00	46	4.36	e	e	e	5.02
17	4.57	e	e	e	10.01	47	7.15	e	e	e	5.02
18	6.02	e	e	e	10.00	48	3.69	e	e	e	5.02
19	6.56	e	e	e	10.03	49	8.42	e	e	e	5.02
20	7.58	e	e	e	10.01	50	9.07	e	e	e	5.02
21	6.80	e	e	e	10.02	51	2.03	e	e	e	5.02
22	7.97	e	e	e	10.02	52	4.90	e	e	e	5.02
23	8.86	e	e	e	10.00	53	5.49	e	e	e	5.02
24	8.81	e	e	e	10.01	54	8.24	e	e	e	5.02
25	9.25	e	e	e	10.01	55	10.01	e	e	e	5.02
26	9.42	e	e	e	10.00	56	10.45	e	e	e	5.03
27	9.19	e	e	e	10.01	57	8.23	e	e	e	5.02
28	8.23	e	e	e	10.00	58	6.84	e	e	e	5.03
29	6.93	e	e	e	10.01	59	8.70	e	e	e	5.02

DATE:	1/18/03 10:29 AM	Winter	Location:	Lagoon 1	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.35	9.42	6.79	7.33	10.00	30	1.50	10.99	7.26	9.82	5.02
1	0.71	9.42	7.03	7.83	9.99	31	1.52	10.99	7.30	9.82	5.02
2	0.57	9.42	7.00	8.23	10.01	32	1.50	10.99	7.03	9.82	5.02
3	0.00	9.53	6.83	8.36	10.02	33	1.01	10.99	7.03	9.82	5.02
4	0.61	9.82	7.03	8.63	10.02	34	1.63	11.03	7.03	9.82	5.02
5	1.44	9.82	6.93	8.63	5.01	35	1.75	11.38	7.10	10.15	5.02
6	0.76	9.82	7.03	8.63	0.13	36	1.30	11.38	7.36	10.21	5.02
7	0.00	9.82	7.03	8.63	0.19	37	1.66	11.38	7.30	10.21	5.02
8	0.00	9.53	7.03	8.63	0.20	38	1.81	11.63	7.36	10.21	5.02
9	0.00	9.78	7.03	8.63	6.24	39	1.36	12.09	7.36	10.34	5.02
10	0.00	9.75	7.03	8.63	9.99	40	2.05	12.16	7.46	10.60	5.02
11	0.38	9.82	7.03	8.83	10.00	41	2.07	12.44	7.70	10.60	5.02
12	1.35	9.82	7.03	9.19	10.01	42	2.07	12.16	7.80	10.60	5.02
13	1.38	9.82	7.03	9.42	10.00	43	2.04	12.41	7.65	10.70	5.02
14	1.56	9.82	7.03	9.69	10.00	44	1.36	12.54	7.70	10.78	5.02
15	1.42	9.75	7.00	9.62	10.00	45	1.48	12.67	7.75	10.85	5.02
16	0.89	9.82	7.03	9.42	10.01	46	1.26	12.80	7.80	10.93	5.02
17	1.17	9.82	7.03	9.03	10.01	47	1.96	12.93	7.85	11.01	5.02
18	1.43	10.03	7.03	9.03	10.01	48	1.98	13.06	7.89	11.09	5.02
19	1.38	10.21	7.16	9.03	9.99	49	1.99	13.18	7.94	11.16	5.02
20	1.31	9.93	7.03	9.16	10.01	50	1.71	13.31	7.99	11.24	5.02
21	0.82	9.86	7.03	9.42	10.02	51	1.26	13.44	8.04	11.32	5.02
22	1.55	10.32	7.03	9.42	10.00	52	1.87	13.57	8.09	11.40	5.02
23	1.39	10.60	7.30	9.42	9.99	53	1.86	13.70	8.14	11.47	5.02
24	0.65	10.60	7.13	9.42	10.00	54	1.77	13.83	8.18	11.55	5.02
25	1.68	10.60	7.33	9.42	10.01	55	1.77	13.96	8.23	11.63	5.02
26	1.69	10.60	7.13	9.42	10.00	56	1.76	14.09	8.28	11.71	5.02
27	1.44	10.99	7.03	9.42	10.01	57	1.71	14.22	8.33	11.78	5.02
28	0.91	10.99	7.03	9.42	10.01	58	1.60	14.35	8.38	11.86	5.02
29	1.52	10.99	7.10	9.75	10.00	59	1.66	14.47	8.43	11.94	5.02

DATE:	1/18/03 11:31 AM	Winter	Location:	Lagoon 1	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.82	12.44	-10.89	0.86	0.14	30	1.18	9.42	6.79	7.33	10.02
1	0.11	14.43	5.39	5.65	0.14	31	1.17	9.42	7.03	7.83	10.00
2	0.13	11.56	1.53	2.85	0.13	32	1.11	9.42	7.00	8.23	10.02
3	0.01	9.75	1.82	25.95	5.05	33	1.16	9.53	6.83	8.36	7.51
4	0.08	8.19	1.56	2.03	9.99	34	1.08	9.82	7.03	8.63	5.02
5	0.32	7.06	1.60	2.14	10.00	35	1.07	9.82	6.93	8.63	5.02
6	0.58	6.29	1.78	2.60	10.00	36	1.10	9.82	7.03	8.63	5.02
7	0.74	5.85	2.07	3.10	10.00	37	1.22	9.82	7.03	8.63	5.02
8	0.86	5.47	1.82	3.31	10.00	38	1.15	9.53	7.03	8.63	5.02
9	0.98	5.14	2.03	3.14	10.00	39	1.25	9.78	7.03	8.63	5.02
10	1.04	4.99	2.03	2.89	10.00	40	1.44	9.75	7.03	8.63	5.02
11	1.02	4.99	2.14	2.89	10.02	41	1.29	9.82	7.03	8.83	5.02
12	1.04	4.99	1.74	2.89	10.01	42	1.27	9.82	7.03	9.19	5.02
13	1.14	4.99	2.14	3.03	10.01	43	1.30	9.82	7.03	9.42	5.02
14	1.08	4.99	2.46	3.31	10.00	44	1.38	9.82	7.03	9.69	5.02
15	1.07	4.99	2.10	3.31	10.01	45	1.29	9.75	7.00	9.62	5.02
16	0.98	4.99	2.03	3.31	10.01	46	1.17	9.82	7.03	9.42	5.02
17	0.97	4.99	2.42	3.31	10.00	47	1.17	9.82	7.03	9.03	5.02
18	0.97	4.99	2.71	3.56	10.01	48	1.16	10.03	7.03	9.03	5.02
19	1.04	5.40	2.89	3.77	10.01	49	1.16	10.21	7.16	9.03	5.02
20	1.06	5.40	2.93	4.12	10.01	50	1.18	9.93	7.03	9.16	5.02
21	1.10	5.40	2.89	4.15	10.01	51	1.17	9.86	7.03	9.42	5.02
22	1.00	5.59	2.89	4.15	10.00	52	1.17	10.32	7.03	9.42	5.02
23	0.60	5.85	3.45	4.40	10.01	53	1.18	10.60	7.30	9.42	5.02
24	1.08	6.37	4.50	4.89	10.00	54	1.17	10.60	7.13	9.42	5.02
25	1.08	6.99	5.43	5.26	10.00	55	1.17	10.60	7.33	9.42	5.02
26	1.07	7.90	5.57	5.61	10.00	56	1.17	10.60	7.13	9.42	5.02
27	1.07	8.81	6.86	5.54	10.02	57	1.11	10.99	7.03	9.42	5.02
28	1.07	9.17	6.83	5.81	10.01	58	1.13	10.99	7.03	9.42	5.02
29	1.14	9.42	6.69	6.49	10.00	59	1.07	10.99	7.10	9.75	5.02

DATE:	1/18/03 12:44 PM	Winter	Location:	Lagoon 1	Sample	3					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.15	e	e	e	10.00	30	1.67	e	e	e	5.02
1	0.21	e	e	e	9.99	31	1.80	e	e	e	5.03
2	0.37	e	e	e	10.01	32	1.78	e	e	e	5.02
3	0.59	e	e	e	10.02	33	1.87	e	e	e	5.02
4	0.75	e	e	e	10.02	34	1.94	e	e	e	5.02
5	0.91	e	e	e	9.99	35	2.09	e	e	e	5.02
6	0.99	e	e	e	10.00	36	2.10	e	e	e	5.02
7	1.07	e	e	e	10.00	37	2.07	e	e	e	5.02
8	1.08	e	e	e	10.01	38	2.08	e	e	e	5.02
9	1.23	e	e	e	10.00	39	2.05	e	e	e	5.03
10	1.42	e	e	e	10.01	40	2.08	e	e	e	5.02
11	1.24	e	e	e	10.00	41	2.16	e	e	e	5.02
12	0.63	e	e	e	10.00	42	2.16	e	e	e	5.03
13	1.13	e	e	e	9.99	43	2.13	e	e	e	5.02
14	1.26	e	e	e	10.00	44	2.24	e	e	e	5.02
15	0.74	e	e	e	10.01	45	2.27	e	e	e	5.02
16	1.22	e	e	e	10.01	46	2.27	e	e	e	5.02
17	1.38	e	e	e	10.02	47	2.05	e	e	e	5.02
18	1.38	e	e	e	10.00	48	1.77	e	e	e	5.03
19	1.46	e	e	e	10.00	49	2.14	e	e	e	5.02
20	1.48	e	e	e	10.01	50	1.84	e	e	e	5.02
21	1.54	e	e	e	10.00	51	2.65	e	e	e	5.02
22	1.58	e	e	e	10.00	52	2.77	e	e	e	5.02
23	1.63	e	e	e	10.01	53	2.77	e	e	e	5.02
24	1.67	e	e	e	10.00	54	2.82	e	e	e	5.03
25	1.66	e	e	e	10.00	55	2.82	e	e	e	5.03
26	1.68	e	e	e	10.01	56	2.87	e	e	e	5.02
27	1.78	e	e	e	10.01	57	2.93	e	e	e	5.02
28	1.74	e	e	e	10.00	58	3.03	e	e	e	5.03
29	1.68	e	e	e	10.01	59	3.06	e	e	e	5.02

DATE:	1/18/03 2:09 PM	Winter	Location:	Lagoon 1	Sample	4					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.27	e	e	e	0.08	30	1.87	e	e	e	10.02
1	0.16	e	e	e	5.86	31	1.91	e	e	e	7.09
2	0.17	e	e	e	10.01	32	1.87	e	e	e	5.03
3	0.41	e	e	e	10.00	33	1.96	e	e	e	5.03
4	0.79	e	e	e	10.02	34	1.97	e	e	e	5.03
5	1.00	e	e	e	10.00	35	2.07	e	e	e	5.03
6	1.14	e	e	e	10.01	36	2.09	e	e	e	5.02
7	1.17	e	e	e	10.01	37	2.23	e	e	e	5.03
8	1.27	e	e	e	10.03	38	2.18	e	e	e	5.02
9	1.39	e	e	e	10.00	39	2.16	e	e	e	5.03
10	1.31	e	e	e	10.00	40	1.38	e	e	e	5.02
11	1.37	e	e	e	10.01	41	2.17	e	e	e	5.02
12	1.37	e	e	e	10.00	42	2.41	e	e	e	5.02
13	1.38	e	e	e	10.00	43	2.47	e	e	e	5.02
14	1.37	e	e	e	10.01	44	2.48	e	e	e	5.02
15	1.37	e	e	e	10.03	45	2.57	e	e	e	5.02
16	1.36	e	e	e	10.02	46	2.57	e	e	e	5.02
17	1.37	e	e	e	10.01	47	2.58	e	e	e	5.02
18	1.15	e	e	e	10.01	48	2.61	e	e	e	5.03
19	1.10	e	e	e	10.00	49	2.71	e	e	e	5.03
20	1.61	e	e	e	10.01	50	2.63	e	e	e	5.03
21	1.77	e	e	e	10.02	51	2.72	e	e	e	5.03
22	1.78	e	e	e	10.01	52	2.68	e	e	e	5.02
23	1.85	e	e	e	10.01	53	2.88	e	e	e	5.02
24	1.85	e	e	e	10.01	54	2.92	e	e	e	5.02
25	1.88	e	e	e	10.01	55	2.97	e	e	e	5.03
26	1.92	e	e	e	10.00	56	2.88	e	e	e	5.02
27	1.87	e	e	e	9.99	57	2.04	e	e	e	5.02
28	1.87	e	e	e	10.01	58	2.99	e	e	e	5.03
29	1.94	e	e	e	10.00	59	3.15	e	e	e	5.02

DATE:	1/18/03 3:17 PM	Winter	Location:	Lagoon 1	Sample	5					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.78	e	e	e	10.04	30	1.95	e	e	e	4.99
1	0.78	e	e	e	10.00	31	1.92	e	e	e	5.02
2	1.25	e	e	e	10.01	32	1.31	e	e	e	5.03
3	1.59	e	e	e	10.01	33	1.74	e	e	e	5.02
4	1.71	e	e	e	10.01	34	1.97	e	e	e	5.03
5	1.78	e	e	e	10.01	35	1.99	e	e	e	5.02
6	1.77	e	e	e	10.01	36	2.04	e	e	e	5.02
7	1.87	e	e	e	10.02	37	2.02	e	e	e	5.03
8	1.82	e	e	e	10.03	38	2.16	e	e	e	5.02
9	1.86	e	e	e	10.01	39	2.23	e	e	e	5.02
10	1.87	e	e	e	10.00	40	2.10	e	e	e	5.02
11	1.94	e	e	e	10.01	41	2.07	e	e	e	5.02
12	1.88	e	e	e	10.01	42	2.07	e	e	e	5.02
13	1.92	e	e	e	10.00	43	2.10	e	e	e	5.02
14	1.96	e	e	e	10.01	44	2.16	e	e	e	5.02
15	2.01	e	e	e	10.00	45	2.07	e	e	e	5.02
16	2.02	e	e	e	10.01	46	2.07	e	e	e	5.02
17	2.05	e	e	e	10.02	47	2.08	e	e	e	5.02
18	2.07	e	e	e	10.00	48	2.12	e	e	e	5.02
19	2.07	e	e	e	10.01	49	1.97	e	e	e	5.02
20	1.80	e	e	e	10.00	50	2.04	e	e	e	5.03
21	1.37	e	e	e	10.01	51	2.02	e	e	e	5.02
22	1.94	e	e	e	10.01	52	2.08	e	e	e	5.03
23	1.87	e	e	e	10.01	53	2.07	e	e	e	5.02
24	1.87	e	e	e	10.01	54	2.08	e	e	e	5.03
25	1.91	e	e	e	10.02	55	2.07	e	e	e	5.02
26	1.89	e	e	e	10.01	56	2.08	e	e	e	5.02
27	1.87	e	e	e	10.02	57	1.99	e	e	e	5.02
28	1.87	e	e	e	10.00	58	2.01	e	e	e	5.02
29	1.92	e	e	e	10.00	59	2.03	e	e	e	5.02

DATE:	1/18/03 4:24 PM	Winter	Location:	Lagoon 1	Sample	6					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.99	e	e	e	9.17	30	2.11	e	e	e	5.44
1	1.09	e	e	e	10.01	31	2.03	e	e	e	5.03
2	1.37	e	e	e	9.99	32	2.14	e	e	e	5.02
3	1.59	e	e	e	10.00	33	2.19	e	e	e	5.03
4	1.68	e	e	e	10.02	34	2.18	e	e	e	5.02
5	1.80	e	e	e	10.01	35	2.17	e	e	e	5.03
6	1.81	e	e	e	10.00	36	2.24	e	e	e	5.03
7	1.10	e	e	e	10.01	37	2.24	e	e	e	5.03
8	1.68	e	e	e	10.02	38	2.27	e	e	e	5.03
9	1.19	e	e	e	9.99	39	2.30	e	e	e	5.03
10	1.81	e	e	e	10.01	40	2.38	e	e	e	5.03
11	1.99	e	e	e	10.01	41	2.38	e	e	e	5.03
12	2.03	e	e	e	10.01	42	2.47	e	e	e	5.03
13	1.98	e	e	e	9.98	43	2.34	e	e	e	5.03
14	1.98	e	e	e	10.00	44	2.43	e	e	e	5.03
15	1.57	e	e	e	10.02	45	2.47	e	e	e	5.02
16	1.62	e	e	e	10.01	46	2.39	e	e	e	5.02
17	2.11	e	e	e	10.01	47	1.52	e	e	e	5.02
18	2.15	e	e	e	10.01	48	2.42	e	e	e	5.03
19	2.13	e	e	e	10.00	49	2.49	e	e	e	5.02
20	2.16	e	e	e	10.00	50	2.35	e	e	e	5.03
21	2.20	e	e	e	10.00	51	1.46	e	e	e	5.02
22	2.10	e	e	e	10.01	52	2.28	e	e	e	5.03
23	2.13	e	e	e	10.01	53	2.36	e	e	e	5.03
24	2.11	e	e	e	9.98	54	2.34	e	e	e	5.02
25	1.35	e	e	e	10.01	55	1.96	e	e	e	5.02
26	2.11	e	e	e	10.01	56	1.21	e	e	e	5.03
27	2.18	e	e	e	10.00	57	1.96	e	e	e	5.03
28	2.18	e	e	e	10.00	58	2.06	e	e	e	5.02
29	2.17	e	e	e	10.01	59	2.03	e	e	e	5.03

DATE:	1/19/03 10:46 AM	Winter	Location:	Lagoon 2	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.00	13.39	-9.27	0.37	6.69	30	0.29	10.21	6.22	9.82	10.00
1	0.00	14.82	9.13	12.03	10.00	31	0.00	10.21	6.22	9.82	8.20
2	0.00	13.49	9.45	10.96	10.01	32	0.00	10.21	6.22	9.59	5.02
3	0.00	12.65	9.49	10.15	10.00	33	0.00	10.21	6.22	9.72	5.02
4	0.12	12.16	10.47	9.82	10.03	34	0.00	10.21	6.22	9.79	5.02
5	0.00	12.44	9.65	9.52	10.00	35	0.00	10.21	6.22	9.79	5.02
6	0.06	12.93	9.49	9.26	10.01	36	0.25	10.21	6.22	9.59	5.03
7	0.13	12.34	9.42	9.82	10.00	37	1.16	10.21	6.22	9.45	5.02
8	0.27	11.88	9.16	9.59	10.02	38	0.01	10.21	6.22	9.42	5.02
9	0.15	11.42	9.29	9.82	10.01	39	0.00	10.21	6.22	9.55	5.03
10	1.01	11.38	6.32	9.65	10.01	40	0.00	10.21	6.22	9.62	5.02
11	0.02	10.99	5.95	9.29	10.02	41	0.00	10.21	6.22	9.82	5.02
12	0.00	10.71	5.88	9.03	10.01	42	0.00	10.21	6.22	9.82	5.02
13	0.05	10.60	5.84	9.59	10.01	43	0.00	10.53	6.22	9.82	5.03
14	0.00	10.32	6.02	10.15	10.01	44	0.00	10.60	6.22	9.82	5.02
15	0.50	10.21	6.15	10.21	10.01	45	0.46	10.60	6.22	9.82	5.02
16	0.04	10.21	6.15	10.21	10.01	46	0.00	10.60	6.22	10.05	5.03
17	0.00	10.21	6.22	10.21	9.99	47	0.49	10.64	6.22	10.21	5.02
18	0.00	10.21	6.22	10.21	10.00	48	0.00	10.99	6.22	10.21	5.02
19	0.72	10.21	6.15	10.21	10.02	49	0.00	10.95	6.22	10.21	5.02
20	0.39	10.21	6.05	10.21	10.01	50	0.00	10.95	6.22	10.21	5.02
21	0.60	10.21	6.15	10.15	10.02	51	0.00	10.99	6.22	10.21	5.02
22	0.00	10.21	6.12	9.82	10.02	52	0.00	10.99	6.22	10.21	5.02
23	0.00	10.21	6.02	9.82	10.02	53	0.00	10.99	6.22	10.21	5.02
24	0.19	10.21	6.22	9.82	10.00	54	0.23	10.99	6.22	10.21	5.02
25	0.57	10.21	6.22	9.82	10.00	55	0.23	10.99	6.22	10.21	5.02
26	0.16	10.21	6.22	9.82	10.00	56	0.00	10.99	6.22	10.21	5.02
27	0.18	10.21	6.22	9.82	10.01	57	0.24	10.99	6.22	10.50	5.02
28	0.00	10.21	6.22	9.82	10.01	58	0.00	10.99	6.22	10.60	5.03
29	0.17	10.21	6.19	9.82	10.01	59	0.51	10.99	6.22	10.60	5.02

DATE:	1/19/03 12:00 PM	Winter	Location:	Lagoon 2	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.07	10.99	6.22	10.60	9.99	30	0.59	10.21	6.22	10.21	5.03
1	0.39	10.99	6.22	10.60	10.02	31	0.00	10.21	6.22	10.21	5.02
2	0.00	10.99	6.22	10.60	10.02	32	0.13	10.21	6.15	10.21	5.02
3	0.05	10.99	6.22	10.60	10.01	33	1.48	10.21	6.05	10.21	5.02
4	0.49	10.99	6.22	10.60	10.01	34	0.20	10.21	6.15	10.15	5.02
5	0.34	10.99	6.22	10.60	10.00	35	0.00	10.21	6.12	9.82	5.02
6	0.00	10.99	6.22	10.60	10.01	36	0.00	10.21	6.02	9.82	5.02
7	0.10	11.13	6.22	10.60	10.02	37	0.00	10.21	6.22	9.82	5.02
8	0.83	11.13	6.22	10.50	10.01	38	0.00	10.21	6.22	9.82	5.02
9	0.00	11.38	6.22	9.85	10.01	39	0.00	10.21	6.22	9.82	5.02
10	0.00	11.31	6.22	9.82	10.02	40	0.53	10.21	6.22	9.82	5.02
11	0.30	10.99	6.22	9.82	10.02	41	0.62	10.21	6.22	9.82	5.02
12	1.67	10.99	6.22	9.98	9.99	42	0.97	10.21	6.19	9.82	5.02
13	0.28	13.39	-9.27	0.37	10.00	43	0.47	10.21	6.22	9.82	5.02
14	0.14	14.82	9.13	12.03	10.01	44	0.79	10.21	6.22	9.82	5.02
15	0.00	13.49	9.45	10.96	10.01	45	1.42	10.21	6.22	9.59	5.02
16	0.30	12.65	9.49	10.15	10.00	46	1.83	10.21	6.22	9.72	5.02
17	1.04	12.16	10.47	9.82	10.02	47	0.08	10.21	6.22	9.79	5.02
18	1.63	12.44	9.65	9.52	10.00	48	1.09	10.21	6.22	9.79	5.02
19	0.28	12.93	9.49	9.26	10.02	49	0.74	10.21	6.22	9.59	5.02
20	0.39	12.34	9.42	9.82	10.00	50	0.62	10.21	6.22	9.45	5.02
21	1.21	11.88	9.16	9.59	10.01	51	0.34	10.21	6.22	9.42	5.02
22	0.41	11.42	9.29	9.82	10.02	52	1.59	10.21	6.22	9.55	5.02
23	0.86	11.38	6.32	9.65	10.01	53	1.89	10.21	6.22	9.62	5.02
24	1.30	10.99	5.95	9.29	10.02	54	0.07	10.21	6.22	9.82	5.02
25	0.69	10.71	5.88	9.03	10.03	55	0.20	10.21	6.22	9.82	5.02
26	0.00	10.60	5.84	9.59	10.02	56	0.52	10.53	6.22	9.82	5.02
27	0.94	10.32	6.02	10.15	10.02	57	0.58	10.60	6.22	9.82	5.02
28	1.93	10.21	6.15	10.21	10.01	58	0.36	10.60	6.22	9.82	5.02
29	0.27	10.21	6.15	10.21	10.02	59	0.97	10.60	6.22	9.82	5.02

DATE:	1/19/03 1:13 PM	Winter	Location:	Lagoon 2	Sample	3					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.00	16.17	27.43	5.83	0.90	30	0.00	13.32	13.73	6.69	9.60
1	0.00	16.07	12.93	9.26	9.99	31	0.68	13.00	13.93	6.65	5.03
2	0.00	15.51	12.93	6.62	10.01	32	1.51	12.93	14.09	6.69	5.02
3	0.00	14.99	12.55	6.55	10.02	33	0.03	12.93	14.09	6.69	5.02
4	0.00	14.19	12.32	6.59	10.01	34	1.09	12.93	14.09	6.65	5.02
5	0.00	13.56	12.16	6.59	10.02	35	0.07	12.93	14.09	6.62	5.02
6	0.36	13.32	12.52	6.62	10.01	36	0.06	12.93	14.41	6.83	5.02
7	0.00	13.70	13.16	6.62	10.01	37	0.21	12.93	14.47	6.89	5.02
8	0.00	13.84	13.32	6.62	10.02	38	0.00	12.93	14.47	6.65	5.03
9	0.00	14.47	13.48	6.62	10.00	39	0.59	12.93	14.47	6.79	5.02
10	0.00	14.37	13.70	6.62	10.03	40	0.25	12.83	14.47	6.76	5.02
11	0.00	14.09	13.70	6.62	10.00	41	0.59	12.93	14.47	6.62	5.02
12	0.00	14.09	13.70	6.62	10.01	42	0.00	12.93	14.47	6.62	5.02
13	0.00	14.09	13.70	6.62	10.01	43	0.00	12.93	14.47	6.83	5.02
14	0.04	13.77	13.70	6.62	10.01	44	0.69	12.93	14.47	6.86	5.02
15	0.15	13.70	13.70	6.62	10.00	45	1.33	12.55	14.47	6.76	5.02
16	0.00	13.74	13.70	6.62	10.02	46	0.70	12.55	14.47	6.83	5.02
17	0.00	13.70	13.70	6.62	10.01	47	0.00	12.55	14.47	6.65	5.02
18	0.00	13.70	13.70	6.62	10.00	48	0.00	12.55	14.47	6.69	5.02
19	0.00	13.74	13.70	6.62	10.01	49	0.00	12.55	14.47	6.96	5.02
20	0.00	13.91	13.70	6.62	10.02	50	0.06	12.55	14.34	6.69	5.02
21	0.00	13.70	13.70	6.62	10.01	51	0.76	12.55	14.47	6.69	5.02
22	0.22	13.70	13.70	6.62	10.02	52	0.88	12.55	14.38	6.79	5.03
23	1.13	13.70	13.70	6.65	10.01	53	0.03	12.55	14.41	6.83	5.02
24	0.10	13.32	13.70	6.62	10.01	54	0.16	12.55	14.31	6.76	5.03
25	0.00	13.32	13.70	6.62	9.99	55	1.42	12.55	14.47	6.79	5.02
26	0.00	13.32	13.70	6.62	10.00	56	0.13	12.55	14.47	7.00	5.02
27	0.00	13.32	13.70	6.62	10.00	57	0.00	12.55	14.47	7.00	5.02
28	0.00	13.32	13.70	6.62	10.01	58	0.16	12.55	14.47	7.03	5.02
29	0.03	13.32	13.70	6.69	10.02	59	1.48	12.55	14.47	7.03	5.02

DATE:	1/19/03 2:15 PM	Winter	Location:	Lagoon 2	Sample	4					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.00	12.55	14.47	7.03	8.35	30	0.00	13.32	13.73	6.69	5.84
1	0.00	12.55	14.47	7.03	10.01	31	0.00	13.00	13.93	6.65	5.02
2	0.00	12.55	13.96	6.83	10.00	32	0.00	12.93	14.09	6.69	5.02
3	0.00	12.55	13.35	7.03	10.01	33	0.01	12.93	14.09	6.69	5.02
4	0.09	12.55	13.32	7.03	10.00	34	1.15	12.93	14.09	6.65	5.03
5	0.52	12.55	13.64	7.03	10.01	35	0.17	12.93	14.09	6.62	5.03
6	0.85	12.55	14.09	7.26	10.00	36	0.00	12.93	14.41	6.83	5.02
7	0.12	12.55	14.44	7.13	10.01	37	0.00	12.93	14.47	6.89	5.02
8	0.00	12.55	14.47	7.13	10.01	38	0.61	12.93	14.47	6.65	5.02
9	0.43	12.55	14.47	7.13	10.03	39	0.98	12.93	14.47	6.79	5.03
10	0.16	12.55	14.47	7.10	10.02	40	0.14	12.83	14.47	6.76	5.02
11	0.00	12.55	14.53	7.16	10.01	41	1.00	12.93	14.47	6.62	5.02
12	0.31	12.55	14.85	7.43	10.00	42	0.13	12.93	14.47	6.62	5.02
13	1.01	13.70	13.70	6.62	10.01	43	0.00	12.93	14.47	6.83	5.03
14	0.00	13.74	13.70	6.62	10.01	44	0.00	12.93	14.47	6.86	5.02
15	0.00	13.70	13.70	6.62	10.00	45	0.00	12.55	14.47	6.76	5.02
16	0.11	13.70	13.70	6.62	10.01	46	0.67	12.55	14.47	6.83	5.02
17	1.04	13.74	13.70	6.62	10.00	47	0.16	12.55	14.47	6.65	5.02
18	0.88	13.91	13.70	6.62	10.01	48	0.00	12.55	14.47	6.69	5.02
19	0.99	13.70	13.70	6.62	10.01	49	0.00	12.55	14.47	6.96	5.02
20	0.00	13.70	13.70	6.62	10.01	50	0.00	12.55	14.34	6.69	5.02
21	0.00	13.70	13.70	6.65	10.00	51	0.68	12.55	14.47	6.69	5.03
22	0.68	13.32	13.70	6.62	10.00	52	0.16	12.55	14.38	6.79	5.02
23	0.47	13.32	13.70	6.62	10.03	53	0.00	12.55	14.41	6.83	5.02
24	0.18	13.32	13.70	6.62	10.01	54	0.11	12.55	14.31	6.76	5.02
25	0.01	13.32	13.70	6.62	9.98	55	0.64	12.55	14.47	6.79	5.02
26	0.75	13.32	13.70	6.62	10.02	56	0.19	12.55	14.47	7.00	5.02
27	0.15	13.32	13.70	6.69	10.01	57	0.84	12.55	14.47	7.00	5.02
28	0.15	13.32	13.70	6.69	10.00	58	1.55	12.55	14.47	7.03	5.02
29	0.68	13.32	13.70	6.69	10.01	59	0.22	12.55	14.47	7.03	5.02

DATE:	1/19/03 3:33 PM	Winter	Location:	Lagoon 2	Sample	5					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.11	16.93	2.57	10.36	9.17	30	0.82	14.09	8.63	16.00	5.44
1	0.29	16.83	9.23	15.43	10.00	31	0.00	14.09	8.63	16.06	5.02
2	0.26	16.21	9.36	15.26	10.01	32	0.00	14.09	8.76	16.38	5.02
3	1.19	15.65	10.05	15.49	10.00	33	0.08	14.09	8.86	16.38	5.02
4	2.30	15.20	9.82	15.84	10.01	34	1.23	14.09	8.13	16.38	5.02
5	1.25	14.85	9.62	16.00	10.01	35	0.02	14.09	7.83	16.38	5.03
6	1.16	14.57	9.69	16.00	10.00	36	0.00	14.09	7.83	16.38	5.02
7	0.12	14.47	9.82	16.00	10.00	37	0.00	14.09	7.83	16.38	5.02
8	0.96	14.47	9.89	16.00	10.01	38	0.02	14.09	7.83	16.38	5.03
9	0.50	14.09	9.23	16.13	10.01	39	0.06	14.09	7.83	16.38	5.03
10	1.20	14.09	8.30	16.38	10.02	40	0.06	14.09	7.83	16.38	5.02
11	0.45	14.09	8.23	16.16	10.00	41	0.06	14.09	7.83	16.38	5.02
12	0.06	14.09	8.60	16.00	10.00	42	0.01	14.09	8.00	16.38	5.02
13	1.04	14.09	8.90	16.00	9.99	43	0.95	14.09	8.40	16.38	5.02
14	0.07	14.09	8.66	16.00	10.00	44	1.39	14.09	8.66	16.67	5.02
15	0.57	14.09	8.36	16.00	10.01	45	0.05	14.09	8.76	16.67	5.03
16	0.08	14.09	8.33	16.00	10.00	46	0.09	14.09	9.46	16.76	5.02
17	1.94	14.02	9.32	16.00	9.99	47	0.76	14.09	10.15	16.76	5.02
18	0.49	13.77	9.52	16.00	10.00	48	0.00	14.09	10.21	16.76	5.02
19	0.98	14.05	9.82	16.00	10.01	49	0.00	14.09	9.98	16.76	5.02
20	0.42	14.09	9.52	16.00	10.01	50	0.00	14.40	9.95	16.76	5.02
21	1.99	14.09	9.42	16.00	10.01	51	0.00	14.47	9.98	16.76	5.02
22	2.24	13.81	9.16	16.00	10.01	52	0.07	14.47	10.67	16.98	5.02
23	1.18	14.09	8.66	16.00	10.00	53	0.66	14.47	10.60	17.14	5.02
24	0.38	14.09	8.63	16.00	10.00	54	0.00	14.47	10.60	17.14	5.02
25	2.81	14.09	8.63	16.00	10.01	55	0.00	14.47	10.93	17.14	5.03
26	1.56	14.09	8.63	16.00	10.00	56	0.01	14.47	10.99	17.14	5.02
27	0.00	14.09	8.63	16.03	10.00	57	0.00	14.47	10.80	17.14	5.02
28	0.64	14.09	8.33	16.06	10.00	58	0.83	14.47	10.70	17.05	5.03
29	0.82	14.09	8.83	16.00	10.01	59	0.38	14.47	11.28	16.38	5.03

DATE:	1/19/03 4:35 PM	Winter	Location:	Lagoon 2	Sample	6					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.00	14.47	10.99	16.38	8.35	30	0.07	15.79	12.14	17.52	5.42
1	0.27	14.47	10.99	16.51	10.02	31	1.40	15.84	12.16	17.52	5.02
2	0.13	14.47	11.38	16.98	10.01	32	0.07	15.89	12.18	17.52	5.02
3	0.74	14.47	11.38	17.14	10.01	33	1.01	15.95	12.21	17.52	5.03
4	0.42	14.47	11.38	17.17	10.00	34	2.94	16.00	12.23	17.52	5.02
5	1.29	14.85	11.45	17.43	10.00	35	1.06	16.05	12.25	17.52	5.02
6	0.15	14.85	11.71	17.52	10.03	36	0.00	16.10	12.28	17.52	5.02
7	0.00	14.85	11.67	17.52	10.01	37	1.03	16.15	12.30	17.52	5.03
8	0.63	14.85	11.71	17.52	10.02	38	1.06	16.20	12.32	17.52	5.03
9	1.88	14.85	11.67	17.52	10.02	39	0.99	16.25	12.35	17.52	5.02
10	0.38	14.85	11.80	17.52	10.02	40	1.02	16.30	12.37	17.52	5.03
11	2.87	14.92	11.77	17.52	9.99	41	0.20	16.35	12.39	17.52	5.02
12	1.69	15.16	11.77	17.52	10.01	42	0.22	16.40	12.42	17.52	5.02
13	1.56	15.09	11.81	17.52	10.02	43	0.62	16.45	12.44	17.52	5.02
14	0.02	15.14	11.84	17.52	10.01	44	1.96	16.50	12.46	17.52	5.02
15	0.00	15.19	11.86	17.52	9.99	45	0.08	16.55	12.49	17.52	5.02
16	0.00	15.24	11.88	17.52	10.00	46	0.00	16.60	12.51	17.52	5.02
17	0.71	15.29	11.91	17.52	10.00	47	0.45	16.65	12.53	17.52	5.02
18	0.74	15.34	11.93	17.52	10.01	48	0.00	16.70	12.56	17.52	5.02
19	0.00	15.39	11.95	17.52	10.00	49	0.39	16.75	12.58	17.52	5.02
20	0.14	15.44	11.98	17.52	10.00	50	0.89	16.80	12.60	17.52	5.03
21	1.46	15.49	12.00	17.52	10.01	51	0.02	16.85	12.63	17.52	5.02
22	1.40	15.54	12.02	17.52	10.02	52	1.06	16.90	12.65	17.52	5.02
23	0.00	15.59	12.05	17.52	10.02	53	0.29	16.95	12.67	17.52	5.02
24	0.54	15.64	12.07	17.52	10.01	54	2.34	17.00	12.70	17.52	5.02
25	0.13	15.69	12.09	17.52	10.01	55	1.08	17.05	12.72	17.52	5.03
26	0.00	15.74	12.12	17.52	10.01	56	1.77	17.10	12.74	17.52	5.02
27	0.00	15.79	12.14	17.52	10.01	57	3.31	17.15	12.77	17.52	5.02
28	0.00	15.84	12.16	17.52	10.01	58	0.05	17.20	12.79	17.52	5.02
29	0.04	15.89	12.18	17.52	10.01	59	0.03	17.25	12.81	17.52	5.02

DATE:	1/17/03 4:52 PM	Winter	Location:	Open Lot	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.32	e	e	e	9.97	30	10.45	e	e	e	5.02
1	6.83	e	e	e	10.01	31	10.31	e	e	e	5.02
2	10.42	e	e	e	9.99	32	8.81	e	e	e	5.02
3	6.51	e	e	e	10.01	33	7.55	e	e	e	5.03
4	7.83	e	e	e	10.02	34	7.24	e	e	e	5.02
5	10.83	e	e	e	10.01	35	9.44	e	e	e	5.02
6	11.16	e	e	e	10.01	36	9.76	e	e	e	5.03
7	11.58	e	e	e	10.01	37	9.41	e	e	e	5.02
8	11.28	e	e	e	10.02	38	9.14	e	e	e	5.02
9	8.32	e	e	e	10.02	39	7.75	e	e	e	5.02
10	10.61	e	e	e	10.01	40	7.58	e	e	e	5.02
11	10.23	e	e	e	9.99	41	8.50	e	e	e	5.01
12	10.36	e	e	e	10.01	42	9.02	e	e	e	5.02
13	9.30	e	e	e	10.00	43	9.14	e	e	e	5.02
14	8.73	e	e	e	10.00	44	9.38	e	e	e	5.03
15	10.98	e	e	e	10.02	45	9.46	e	e	e	5.02
16	10.97	e	e	e	10.00	46	9.55	e	e	e	5.02
17	11.27	e	e	e	9.99	47	9.88	e	e	e	5.02
18	10.77	e	e	e	10.01	48	10.36	e	e	e	5.02
19	11.04	e	e	e	10.00	49	10.31	e	e	e	5.02
20	10.98	e	e	e	10.00	50	10.43	e	e	e	5.02
21	10.67	e	e	e	10.00	51	10.27	e	e	e	5.02
22	9.46	e	e	e	10.00	52	10.45	e	e	e	5.02
23	8.58	e	e	e	10.02	53	10.38	e	e	e	5.02
24	8.16	e	e	e	9.98	54	10.13	e	e	e	5.02
25	2.83	e	e	e	10.00	55	9.76	e	e	e	5.02
26	10.02	e	e	e	9.99	56	9.95	e	e	e	5.02
27	10.29	e	e	e	10.02	57	9.89	e	e	e	5.02
28	10.29	e	e	e	10.02	58	8.96	e	e	e	5.02
29	10.00	e	e	e	10.00	59	7.10	e	e	e	5.02

DATE:	1/17/03 5:54 PM	Winter	Location:	Open Lot	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	6.97	e	e	e	10.00	30	6.52	e	e	e	5.02
1	6.08	e	e	e	9.99	31	9.90	e	e	e	5.03
2	7.08	e	e	e	10.01	32	10.44	e	e	e	5.02
3	7.63	e	e	e	10.00	33	8.18	e	e	e	5.02
4	8.03	e	e	e	10.00	34	8.00	e	e	e	5.03
5	8.21	e	e	e	10.01	35	10.74	e	e	e	5.03
6	8.31	e	e	e	9.99	36	10.46	e	e	e	5.02
7	8.50	e	e	e	10.03	37	10.44	e	e	e	5.02
8	8.36	e	e	e	10.01	38	10.62	e	e	e	5.02
9	8.98	e	e	e	10.00	39	10.64	e	e	e	5.02
10	9.15	e	e	e	10.02	40	10.39	e	e	e	5.02
11	9.32	e	e	e	10.00	41	10.89	e	e	e	5.02
12	9.00	e	e	e	10.02	42	10.85	e	e	e	5.03
13	9.20	e	e	e	10.00	43	11.14	e	e	e	5.03
14	9.64	e	e	e	10.00	44	11.18	e	e	e	5.02
15	9.72	e	e	e	10.02	45	11.86	e	e	e	5.02
16	9.65	e	e	e	10.01	46	9.92	e	e	e	5.02
17	8.31	e	e	e	10.00	47	10.07	e	e	e	5.02
18	6.61	e	e	e	10.02	48	8.81	e	e	e	5.02
19	8.23	e	e	e	10.01	49	11.76	e	e	e	5.02
20	7.39	e	e	e	10.03	50	11.87	e	e	e	5.02
21	10.26	e	e	e	10.01	51	12.15	e	e	e	5.02
22	10.52	e	e	e	10.00	52	12.02	e	e	e	5.03
23	10.45	e	e	e	10.00	53	12.14	e	e	e	5.02
24	10.14	e	e	e	10.02	54	11.45	e	e	e	5.02
25	10.02	e	e	e	10.00	55	11.90	e	e	e	5.02
26	9.76	e	e	e	10.00	56	11.80	e	e	e	5.02
27	9.60	e	e	e	10.01	57	11.48	e	e	e	5.02
28	9.09	e	e	e	9.99	58	11.14	e	e	e	5.02
29	6.39	e	e	e	9.99	59	11.38	e	e	e	5.02

DATE:	1/17/03 6:56 PM	Winter	Location:	Open Lot	Sample	3					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	10.27	e	e	e	9.21	30	2.72	e	e	e	5.43
1	4.59	e	e	e	10.01	31	2.67	e	e	e	5.02
2	3.39	e	e	e	10.01	32	2.80	e	e	e	5.02
3	2.99	e	e	e	10.00	33	2.83	e	e	e	5.02
4	2.87	e	e	e	9.99	34	2.24	e	e	e	5.02
5	2.23	e	e	e	10.02	35	1.93	e	e	e	5.02
6	2.18	e	e	e	10.01	36	2.79	e	e	e	5.02
7	2.83	e	e	e	10.04	37	2.90	e	e	e	5.02
8	2.87	e	e	e	9.99	38	2.90	e	e	e	5.02
9	2.86	e	e	e	10.00	39	2.91	e	e	e	5.02
10	2.98	e	e	e	10.00	40	2.14	e	e	e	5.02
11	2.94	e	e	e	9.99	41	1.76	e	e	e	5.02
12	2.91	e	e	e	10.01	42	2.95	e	e	e	5.02
13	2.81	e	e	e	10.01	43	3.02	e	e	e	5.02
14	2.76	e	e	e	10.01	44	2.90	e	e	e	5.02
15	1.97	e	e	e	10.00	45	2.88	e	e	e	5.02
16	2.90	e	e	e	10.00	46	2.76	e	e	e	5.02
17	3.04	e	e	e	10.02	47	1.89	e	e	e	5.02
18	3.12	e	e	e	9.99	48	2.70	e	e	e	5.02
19	2.57	e	e	e	10.00	49	2.90	e	e	e	5.02
20	1.82	e	e	e	10.00	50	2.81	e	e	e	5.02
21	2.36	e	e	e	9.99	51	2.16	e	e	e	5.02
22	3.09	e	e	e	10.01	52	1.59	e	e	e	5.02
23	3.00	e	e	e	9.99	53	2.11	e	e	e	5.02
24	2.15	e	e	e	9.99	54	2.60	e	e	e	5.02
25	2.94	e	e	e	10.00	55	2.61	e	e	e	5.03
26	3.13	e	e	e	10.01	56	2.58	e	e	e	5.03
27	3.06	e	e	e	10.00	57	2.05	e	e	e	5.02
28	2.96	e	e	e	10.01	58	1.98	e	e	e	5.02
29	2.87	e	e	e	9.99	59	1.99	e	e	e	5.02

DATE:	1/17/03 8:03 PM	Winter	Location:	Open Lot	Sample	4					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	4.61	e	e	e	8.36	30	7.03	e	e	e	5.60
1	5.36	e	e	e	9.96	31	7.09	e	e	e	5.02
2	5.81	e	e	e	10.01	32	7.30	e	e	e	5.02
3	6.00	e	e	e	9.99	33	7.34	e	e	e	5.02
4	6.12	e	e	e	10.01	34	7.56	e	e	e	5.02
5	6.14	e	e	e	10.01	35	7.53	e	e	e	5.02
6	6.11	e	e	e	10.00	36	7.67	e	e	e	5.02
7	6.05	e	e	e	9.99	37	7.61	e	e	e	5.02
8	6.18	e	e	e	10.02	38	7.60	e	e	e	5.02
9	6.25	e	e	e	10.02	39	7.55	e	e	e	5.02
10	6.26	e	e	e	10.00	40	7.78	e	e	e	5.02
11	6.18	e	e	e	10.01	41	7.82	e	e	e	5.02
12	6.27	e	e	e	10.01	42	7.77	e	e	e	5.02
13	6.26	e	e	e	10.01	43	5.58	e	e	e	5.02
14	6.35	e	e	e	10.00	44	7.40	e	e	e	5.02
15	6.26	e	e	e	10.02	45	7.73	e	e	e	5.02
16	6.31	e	e	e	10.03	46	7.89	e	e	e	5.02
17	6.43	e	e	e	10.02	47	7.87	e	e	e	5.02
18	6.57	e	e	e	9.99	48	7.88	e	e	e	5.02
19	6.48	e	e	e	10.02	49	7.76	e	e	e	5.02
20	6.52	e	e	e	9.98	50	7.86	e	e	e	5.02
21	6.56	e	e	e	9.99	51	7.76	e	e	e	5.02
22	6.70	e	e	e	10.00	52	7.87	e	e	e	5.02
23	6.62	e	e	e	10.00	53	7.87	e	e	e	5.02
24	6.71	e	e	e	10.01	54	7.96	e	e	e	5.02
25	6.65	e	e	e	10.02	55	7.89	e	e	e	5.02
26	6.81	e	e	e	10.00	56	7.81	e	e	e	5.02
27	6.82	e	e	e	9.99	57	7.53	e	e	e	5.02
28	6.91	e	e	e	10.01	58	5.46	e	e	e	5.02
29	6.89	e	e	e	9.99	59	7.48	e	e	e	5.02

DATE:	1/17/03 9:11 PM	Winter	Location:	Open Lot	Sample	5					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	12.35	e	e	e	6.69	30	13.54	e	e	e	6.68
1	12.39	e	e	e	10.00	31	13.52	e	e	e	5.02
2	11.39	e	e	e	10.01	32	13.97	e	e	e	5.02
3	11.62	e	e	e	9.97	33	14.25	e	e	e	5.02
4	11.45	e	e	e	10.00	34	14.52	e	e	e	5.02
5	11.10	e	e	e	9.99	35	14.29	e	e	e	5.02
6	10.68	e	e	e	10.01	36	14.46	e	e	e	5.03
7	8.33	e	e	e	10.03	37	13.77	e	e	e	5.02
8	11.51	e	e	e	10.00	38	14.44	e	e	e	5.02
9	11.48	e	e	e	10.00	39	14.33	e	e	e	5.02
10	12.06	e	e	e	10.01	40	14.38	e	e	e	5.03
11	12.19	e	e	e	10.00	41	14.14	e	e	e	5.02
12	12.22	e	e	e	10.02	42	14.22	e	e	e	5.02
13	12.27	e	e	e	9.99	43	14.28	e	e	e	5.02
14	12.37	e	e	e	10.01	44	14.56	e	e	e	5.02
15	12.34	e	e	e	10.01	45	14.38	e	e	e	5.02
16	12.45	e	e	e	10.00						
17	12.63	e	e	e	10.00						
18	12.86	e	e	e	9.98						
19	12.37	e	e	e	10.01						
20	9.58	e	e	e	10.00						
21	12.73	e	e	e	10.00						
22	13.00	e	e	e	10.00						
23	12.96	e	e	e	10.01						
24	13.13	e	e	e	10.00						
25	13.10	e	e	e	10.00						
26	13.18	e	e	e	10.04						
27	13.18	e	e	e	9.98						
28	13.34	e	e	e	10.02						
29	13.28	e	e	e	10.02						

DATE:	1/17/03 10:13 PM	Winter	Location:	Open Lot	Sample	6					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	0.03	6.44	-5.81	1.03	7.52	30	17.02	-1.31	-1.06	2.89	6.28
1	0.01	6.11	-0.16	2.35	9.98	31	17.45	-1.51	-1.06	2.89	5.02
2	0.00	4.42	-0.24	2.46	10.01	32	18.29	-1.51	-1.06	2.89	5.02
3	0.00	3.24	-0.20	2.46	9.98	33	18.47	-1.51	-1.06	2.89	5.02
4	0.00	2.42	-0.31	2.46	10.00	34	18.05	-1.51	-1.06	2.89	5.02
5	0.00	1.80	-0.39	2.46	10.02	35	18.62	-1.51	-1.06	2.89	5.02
6	0.00	1.21	-0.46	2.50	10.03	36	19.17	-1.51	-1.06	2.89	5.03
7	0.00	0.93	-0.42	2.53	10.01	37	19.15	-1.51	-1.06	2.89	5.02
8	0.00	0.49	-0.61	2.78	10.00	38	19.28	-1.51	-1.06	2.89	5.02
9	0.00	0.29	-0.61	2.85	10.03	39	19.22	-1.51	-1.06	2.89	5.02
10	0.00	-0.12	-0.61	2.89	10.01	40	19.31	-1.51	-1.06	2.89	5.02
11	0.00	-0.16	-0.61	2.89	10.04	41	19.03	-1.51	-1.06	2.89	5.02
12	0.11	-0.45	-0.61	2.89	10.03	42	18.62	-1.51	-1.06	2.89	5.02
13	0.08	-0.61	-0.61	2.89	10.01	43	19.33	-1.51	-1.06	2.89	5.02
14	0.00	-0.61	-0.72	2.89	10.02	44	19.39	-1.51	-1.06	2.89	5.02
15	0.00	-0.61	-0.95	2.89	10.01	45	19.38	-1.51	-1.06	2.89	5.02
16	1.23	-0.81	-0.95	2.89	9.99	46	19.43	-1.51	-1.06	2.89	5.02
17	12.48	-1.06	-1.02	2.89	10.01	47	19.46	-1.51	-1.06	2.89	5.02
18	16.67	-1.06	-1.02	2.89	9.99	48	19.40	-1.51	-1.06	2.89	5.02
19	16.59	-1.06	-1.06	2.89	10.01	49	19.48	-1.51	-1.06	2.89	5.02
20	16.78	-1.06	-1.06	2.89	10.00	50	19.33	-1.51	-1.06	2.89	5.02
21	16.68	-1.06	-1.06	2.89	10.00	51	19.45	-1.51	-1.06	2.89	5.03
22	11.80	-1.06	-1.06	2.89	10.00	52	19.29	-1.51	-1.06	2.89	5.03
23	11.43	-1.06	-1.06	2.89	10.02	53	14.94	-1.51	-1.06	2.89	5.02
24	17.16	-1.06	-1.06	2.89	10.01	54	18.00	-1.51	-1.06	2.89	5.02
25	17.08	-1.06	-1.06	2.89	10.02	55	18.16	-1.51	-1.06	2.89	5.03
26	17.12	-1.06	-1.06	2.89	10.01	56	15.08	-1.51	-1.06	2.89	5.02
27	16.55	-1.06	-1.06	2.89	10.01	57	19.86	-1.72	-1.06	2.89	5.02
28	17.36	-1.06	-1.06	2.89	10.01	58	19.93	-1.97	-1.06	2.89	5.03
29	17.38	-1.10	-1.06	2.89	10.00	59	20.13	-1.97	-1.06	2.89	5.02

DATE:	1/17/03 11:15 PM	Winter	Location:	Open Lot	Sample	7					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	8.59	11.06	-8.37	-4.80	9.99	30	9.88	-3.20	-1.97	2.46	5.03
1	9.42	9.74	-1.97	2.46	10.01	31	11.93	-3.37	-1.97	2.46	5.03
2	9.82	6.73	-1.97	2.46	10.00	32	13.50	-3.81	-1.97	2.46	5.03
3	9.99	4.46	-1.97	2.46	9.99	33	13.64	-3.85	-1.97	2.46	5.02
4	7.74	2.69	-1.97	2.46	9.99	34	13.11	-3.85	-1.97	2.46	5.02
5	9.43	1.37	-1.97	2.46	10.01	35	13.11	-3.85	-1.97	2.46	5.02
6	10.41	0.29	-1.97	2.46	10.01	36	13.40	-4.02	-1.97	2.46	5.02
7	10.38	-0.49	-1.97	2.46	9.99	37	13.56	-3.54	-1.97	2.46	5.02
8	10.53	-1.10	-1.97	2.46	10.01	38	13.48	-3.85	-1.97	2.46	5.02
9	10.64	-1.59	-1.97	2.46	10.00	39	13.61	-3.85	-1.97	2.46	5.02
10	10.87	-1.97	-1.97	2.46	10.01	40	13.42	-3.85	-1.97	2.46	5.02
11	11.05	-2.44	-1.97	2.46	9.99	41	13.50	-3.85	-1.97	2.46	5.02
12	10.34	-2.52	-1.97	2.46	10.02	42	13.30	-3.85	-1.97	2.46	5.02
13	8.69	-2.90	-1.97	2.46	10.00	43	13.33	-3.85	-1.97	2.46	5.03
14	11.52	-2.99	-1.97	2.46	10.02	44	13.13	-3.85	-1.97	2.46	5.01
15	11.45	-3.37	-1.97	2.46	9.98	45	13.28	-3.85	-1.97	2.46	5.02
16	11.23	-3.37	-1.97	2.46	10.02	46	12.99	-3.85	-1.97	2.46	5.02
17	11.78	-3.37	-1.97	2.46	10.03	47	12.97	-3.85	-1.97	2.46	5.02
18	11.96	-3.37	-1.97	2.46	10.01	48	12.60	-3.85	-1.97	2.46	5.02
19	12.14	-3.54	-1.97	2.46	10.02	49	12.40	-3.85	-1.97	2.46	5.02
20	12.21	-3.85	-1.97	2.46	10.02	50	11.97	-3.42	-1.97	2.46	5.02
21	12.40	-3.85	-1.97	2.46	10.04	51	11.75	-2.90	-1.97	2.46	5.02
22	12.49	-3.85	-1.97	2.46	9.99	52	9.73	-3.37	-1.97	2.46	5.02
23	12.59	-3.85	-1.97	2.46	10.04	53	12.90	-3.37	-1.97	2.46	5.02
24	9.57	-3.85	-1.97	2.53	10.02	54	12.87	-2.69	-4.52	2.02	5.02
25	11.03	-3.85	-1.97	2.53	10.01	55	12.96	e	e	e	5.03
26	10.64	-3.98	-1.97	2.46	9.97	56	12.79	e	e	e	5.01
27	7.87	-1.72	-1.97	2.46	9.99	57	12.80	e	e	e	5.04
28	12.67	-2.40	-1.97	2.46	10.03	58	12.85	e	e	e	5.02
29	13.05	-2.61	-1.97	2.46	7.52	59	13.16	e	e	e	3.42

DATE:	1/17/03 9:50 AM	Winter	Location:	Separated Solids	Sample	1					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	3.62	9.42	5.52	3.39	9.99	30	7.95	e	1.17	2.89	5.01
1	5.28	9.35	2.67	-1.14	10.01	31	9.22	e	1.17	2.89	5.02
2	6.12	8.74	-1.52	-0.65	9.99	32	10.31	e	1.17	2.89	5.01
3	6.61	6.84	-3.06	-0.01	9.95	33	10.42	e	1.17	2.89	5.01
4	6.47	5.14	-3.37	-0.31	10.00	34	6.87	e	1.17	2.89	5.02
5	4.98	3.73	-2.18	-1.10	10.01	35	8.78	e	1.17	2.89	5.02
6	4.40	4.57	-0.80	2.57	10.01	36	10.59	e	1.17	2.89	5.02
7	5.65	4.34	-0.31	3.31	10.02	37	10.69	e	1.17	2.89	5.02
8	5.54	3.96	-0.16	3.45	9.99	38	10.11	e	1.21	2.89	5.02
9	7.66	3.62	-0.05	3.53	10.01	39	10.43	e	1.42	2.89	5.02
10	7.65	3.27	0.29	3.49	10.00	40	10.32	e	1.60	2.89	5.02
11	7.61	2.89	0.29	3.35	10.01	41	10.45	e	1.60	2.89	5.02
12	8.03	2.50	0.29	3.31	10.00	42	10.24	e	1.60	2.89	5.02
13	8.12	2.23	0.29	3.31	10.03	43	10.40	e	1.60	2.89	5.02
14	7.81	2.03	0.29	3.31	10.02	44	10.98	e	1.60	2.89	5.02
15	7.98	1.60	0.29	3.31	10.00	45	8.61	e	1.60	2.89	5.02
16	8.13	1.52	0.29	3.31	10.01	46	9.92	e	1.60	2.89	5.02
17	6.78	1.17	0.47	3.31	10.02	47	10.83	e	1.60	2.89	5.02
18	7.21	1.17	0.73	3.31	10.01	48	11.10	e	1.60	2.89	5.02
19	6.06	0.97	0.73	3.31	10.00	49	10.22	e	1.60	2.89	5.02
20	6.57	0.73	0.73	3.31	10.00	50	6.57	e	1.60	2.89	5.02
21	8.52	0.73	0.73	3.28	10.00	51	11.25	e	1.78	2.89	5.02
22	6.65	0.33	0.73	3.00	10.00	52	11.13	e	1.89	2.89	5.02
23	8.45	0.29	0.73	2.89	10.01	53	11.61	e	2.03	2.89	5.02
24	8.63	0.29	0.73	2.89	10.02	54	9.18	e	2.03	2.89	5.02
25	7.34	0.29	0.73	2.89	10.01	55	10.41	e	2.03	2.89	5.02
26	5.75	0.29	0.84	2.89	9.99	56	11.78	e	2.03	2.89	5.02
27	5.56	0.29	0.91	2.89	6.68	57	11.21	e	2.03	2.89	4.95
28	7.23	0.04	1.13	2.89	5.02						
29	10.05	e	1.17	2.89	5.02						

DATE:	1/17/03 10:52 AM	Winter	Location:	Separated Solids	Sample	2					
Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow	Minutes	NH_3 PPM	Temp Ambient °C	Temp Chamber °C	Temp Ground °C	Zero Air Flow
0	1.40	12.86	1.17	-10.90	10.02	30	9.28	2.03	0.73	2.03	5.03
1	7.66	11.59	0.58	2.85	10.01	31	9.07	2.03	0.73	2.03	5.02
2	7.01	9.21	1.17	2.89	10.01	32	9.19	2.03	0.73	2.03	5.02
3	7.27	7.58	1.17	2.89	10.02	33	9.40	2.03	0.73	2.03	5.02
4	6.38	6.33	1.17	2.57	9.99	34	9.47	2.03	0.73	2.03	5.02
5	4.68	5.36	1.02	2.46	10.02	35	6.83	2.03	0.73	2.03	5.02
6	5.82	4.53	0.95	2.46	10.00	36	7.66	2.03	0.84	2.03	5.02
7	5.67	3.89	0.84	2.46	10.01	37	7.35	2.03	0.99	2.03	5.02
8	6.43	3.43	0.73	2.46	10.01	38	6.91	2.03	1.13	2.03	5.02
9	5.79	3.00	0.73	2.46	9.99	39	8.60	2.03	1.17	2.03	5.02
10	7.88	2.81	0.73	2.46	10.00	40	9.35	2.03	1.17	2.03	5.02
11	8.02	2.46	0.73	2.46	10.00	41	8.47	2.15	1.17	2.03	5.02
12	6.63	2.34	0.73	2.46	10.01	42	7.54	2.42	1.17	2.03	5.02
13	5.28	2.03	0.73	2.46	10.01	43	7.18	2.46	1.17	2.03	5.02
14	8.21	2.03	0.73	2.46	10.01	44	9.29	2.46	1.17	2.03	5.02
15	8.27	2.03	0.73	2.42	10.00	45	9.76	2.46	1.17	2.03	5.02
16	6.51	1.99	0.73	2.28	10.00	46	7.24	2.46	1.17	2.03	5.02
17	5.38	1.60	0.73	2.25	10.00	47	6.63	2.62	1.17	2.03	5.02
18	8.57	1.60	0.73	2.25	10.00	48	6.78	2.89	1.17	2.03	5.02
19	8.59	1.60	0.73	2.07	10.01	49	9.56	2.89	1.17	2.03	5.02
20	8.67	1.60	0.73	2.03	10.00	50	10.36	2.89	1.17	2.03	5.02
21	7.69	1.60	0.69	2.03	10.00	51	10.30	2.89	1.17	2.03	5.02
22	5.81	1.60	0.73	2.03	10.01	52	10.19	2.89	1.17	2.03	5.02
23	6.88	1.60	0.73	2.03	10.00	53	7.26	2.89	1.35	2.03	5.02
24	8.90	1.60	0.73	2.03	10.02	54	9.34	2.89	1.56	2.03	5.02
25	8.73	1.60	0.73	2.03	10.00	55	10.29	2.89	1.60	2.03	5.02
26	8.65	1.60	0.73	2.03	10.01	56	10.46	2.89	1.60	2.03	5.02
27	6.56	1.60	0.73	2.03	10.00	57	9.89	3.35	1.39	-7.87	5.02
28	8.61	1.80	0.73	2.03	10.01	58	10.37	4.36	1.17	-10.56	5.02
29	9.32	1.87	0.73	2.03	10.01						

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The author was born in Beaumont, Texas on February 20, 1979. He graduated from Friendswood High School in 1997 and Texas A&M University in 2001. While at Texas A&M the author was involved in various clubs and activities including: The American Society of Agricultural Engineers student branch, Lambda Chi Alpha International Fraternity, and Phi Kappa Phi honor society. The author currently resides in Dallas, Texas with his wife, whom he met while at Texas A&M and married while completing this thesis.