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Bioaerosols and the risk of upper respiratory infection in dental hygienists

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BIOAEROSOLS AND THE RISK OF UPPER RESPIRATORY INFECTIONS IN DENTAL HYGIENISTS

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ABSTRACT

Multitudes of pathogenic and infectious microbes are known to spread via contaminated aerosols. Dental personnel have an increased incidence of respiratory infections. Ultrasonic scaling procedures are reported to produce the largest amounts of contaminated aerosols of any dental procedure. The goal of the current study was to see if dental hygienists are at an increased risk of respiratory infections during the performance of their job and to see if certain dental procedures had a significant effect on this risk. This study was conducted at the Dental Hygiene Clinic of the Louisiana State University School of Dentistry in New Orleans, LA. An air monitor collected air composition data during various dental hygiene procedures, and a survey was given to dental hygiene students. The current study found significant increases in particle counts, aerosols and particulates, during ultrasonic scaling procedures. This significant increase in particle counts for a range of particles, 0.5-5.0 micron in diameter, was shown at the onset ($p=0.0002$) as well as throughout ultrasonic scaling procedures ($p=0.0063$). Aerosols of the 0.5-1.0 micron size range produced by dental procedures presents an important transportation mechanism since pathogenic bacteria and viruses can easily be carried by these size particles. Therefore, these results clarify the potential for significant risk of respiratory infection in dental hygienists. Recommendations are provided to help reduce this increased risk of aerosol mediated pathogen exposure during dental procedures. Survey analysis determined that receiving a flu shot the previous year had a significant effect on the likelihood of experiencing respiratory symptoms.

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

It is well understood that microorganisms exist on nearly all surfaces, many of them pathogenic. The dental setting represents a high risk environment for the potential spread of infectious organisms. The reason for this is two-fold: the location of dental procedures inside the oral cavity and the high-speed instruments used to perform dental work require water for proper operation. Due to this, potentially infectious aerosols are produced in relatively high rates and amounts during these dental procedures. The produced aerosols can be plagued with particulate matter such as tooth debris, tissue, calculus particles, and restorative materials; organic fluids such as blood and saliva; and pathogenic microbes such as bacteria, viruses, fungi and allergens (19). It is well known that viruses and bacteria are often transported via the air and more specifically via aerosols and particulates. Knowing and understanding this, dental hygienists take certain precautions to avoid the spread of these substances including the wearing of gloves, face masks, gowns and goggles while working with patients. While the adoption of these practices has no doubt reduced the spread of germs, the question remains if dental hygienists are still at an increased risk of upper respiratory infections.

Some procedures may pose a higher risk than others to dental hygienists, such as the use of the ultrasonic scaler. The scaler tip of this machine is exactly like a normal hand scaler typically used by dental hygienists to scrape plaque off tooth surfaces. The other end has a water supply and a small motor on it. The water helps keep the tooth cool and flushed during the procedure and ensures that the scaler vibrates correctly. The motor moves the scaler very fast allowing for the removal of much larger amounts of plaque compared to hand scaling. This combination creates a visibly noticeable amount of aerosol production near the patient's mouth. During this procedure, the dental hygienist always uses personal barrier protection including: mask, gloves, gown, and goggles. However, these protective measures do not provide complete protection. With the design and use of these measures, the dental

hygienist is still at risk of infection through direct exposure (mask removal) or indirect exposure (leakage from the side of protective wear).

A fundamental principle of toxicology is that the dose makes the poison. The same is true in dealing with biological pathogens. The dose of pathogenic organisms often determines whether or not the immune system will be able to quickly eliminate a virus or bacterium or if the system will be bombarded and overwhelmed, leading to sickness and/or chronic infections. Most of the time, the immune system is more than equipped to handle a small dose of what one could consider some of the most deadly microbes. Dental hygienists are not routinely exposed to deadly microbes. However, some viruses and bacteria common to the dental setting are of concern. From the patient, these include: tuberculosis, the common cold, influenza, Herpes viruses, pathogenic *streptococci* and *staphylococci* species, and the SARS virus (6).

The other common source for contamination is the water line source in the dental office. The major organisms of concern from this source are *Legionella* spp., *Mycobacteria* spp., and *Pseudomonas* spp. There have been countless examples of water source contamination in hospitals and dental offices (18). Some of these were the result of pathogenic biofilms (layer of microorganisms adhering to the surface of a structure) in the water lines. Biofilms have been reported to develop in the hospital water lines (18), and can develop in dental water lines in the same manner. The potentially contaminated water in this instance not only poses a threat to the dental hygienist, but also to the patient. The added danger in dental hygiene practices is the aerosolization of potentially contaminated water. Ingestion or direct contact (skin) is not necessary for infection. An individual may be infected by either inhaling these particles or from absorption into the mucous membranes of the eye due to the minute size of the aerosolized particles.

Until recently, the dental clinic was not considered as important as most hospital facilities regarding infection control. Because of the nature of dental procedures, the potential for the spread of

dangerous pathogenic microbes in clinics, operatory rooms, patient rooms, waiting areas, etc. remains high (18). Only recently have studies begun to evaluate the dental environment for air quality and contamination issues.

1.2 Aerosols and Splatter

Most bioaerosol studies make a distinction within the particles produced between aerosols and splatter. Aerosols are often defined as droplets <50µm diameter. Exposure to aerosols presents a significant risk because they are invisible to the naked eye and easily inhaled. Particle size greatly influences the site of deposition of these particles in the respiratory tract and the survival of microbes in the aerosol (24). Smaller particles such as viruses (0.02µm – 0.4µm) and bacteria (0.25µm – 4.0µm) deposit in the lungs and alveoli, while larger particles (>10µm) such as fungi, deposit in the upper respiratory tract. Particle size also determines the suspension time for aerosolized microorganisms (24). The suspension time may be short (seconds), but it is still long enough to allow transport by moving air currents or other nearby disturbances.

Particles >50µm in diameter are referred to as splatter. These particles are not as easily inhaled and do not remain suspended in the air. Instead, due to their size, they possess kinetic energy and are described to travel in a trajectory similar to a bullet (6). These particles are more likely to deposit on dental surfaces and the clothes, hair, skin, eyes and mucous membranes of dental personnel. The particles may be absorbed by these surfaces. If not absorbed, they may dry out, evaporate and become smaller particles. These smaller particles, known as droplet nuclei, fall back into the category of aerosols and are capable of being inhaled.

Various studies have claimed that the majority of aerosols produced during dental procedures are 5µm in diameter (13, 15, 22). While this is claimed, the only study that reports 5µm diameter size particulates dates back to 1969 (12), years before the use of ultrasonic scalers. The present study addresses this issue.

1.3 Sources of Infection

In most cases, the major source of infection in a dental setting is the patient. Although, the dental unit water line (DUWL) presents a potentially large source of infection as well. There are four basic routes of entry for spreading infectious microorganisms in a dental setting: blood-borne, saliva-droplet, direct contact and water-droplet (21). The patient is generally the source of the blood-borne and saliva-droplet routes, but the dental hygienist could be a source as well. The third, direct contact, may be from the patient and/or contaminated equipment. The sources of the water-droplet route are biofilms and other microorganisms in the DUWL.

The greatest risks for dental personnel are from blood-borne viral pathogens, such as hepatitis B and C, HIV, and HPV because they can cause serious and life-threatening diseases (21). The risks posed by these viruses to dental personnel have been thoroughly studied and are considered to be a biological hazard in dentistry (21). The risks associated with the saliva-borne and direct contact routes include prions, viruses, bacteria and fungi. *Herpes simplex* virus is one of the better known and studied risk factors spread by this route (21). Bacteria from the *Mycobacteria* spp.*, Pseudomonas* spp. and *Legionella* spp. are thought to constitute the greatest infection risk from the water-droplet route. However, gram-negative rods, which produce endotoxins and allergens, are also an important risk factor (21). In the case of DUWL, biofilms formed within the lines essentially serve as breeding grounds for these pathogenic microorganisms, presenting them with sufficient nutrients and protection to reproduce, multiply and develop substantial numbers very quickly.

1.3.1 Blood-borne

Hepatitis B virus (HBV) contains DNA and is highly infectious, able to be transmitted by blood and saliva and highly resistant to disinfection and sterilization techniques. This virus may be transmitted to the dental personnel through needlesticks, percutaneous injuries and the aerosolization of blood, saliva and/or gingival secretions. The virus can cause asymptomatic acute or chronic infections, which

may lead to cirrhosis or liver cancer. Dental personnel are estimated to be exposed to 10 times higher risk of infection with chronic hepatitis B than the average individual. General vaccinations and the introduction of disposable needles and syringes have reduced this virus from being the most common occupational infectious disease in dentists, but hepatitis B virus still remains a very serious hazard to all dental personnel (21).

Hepatitis C virus (HCV) is a blood-borne virus containing RNA; it is epidemiologically similar to HBV as it is asymptomatic and can cause chronic liver inflammation, eventually leading to cirrhosis and liver cancer. HCV is less infectious than HBV, but with no vaccines available, the occupational risk is still high. Also, patients with HCV are more prone to extensive dental disease thereby likely increasing the degree to which dental personnel will be exposed to it (21).

Human immunodeficiency virus (HIV) is an RNA-containing retrovirus, which causes the acquired immunodeficiency syndrome (AIDS). It is spread through blood and sexual contact. The virus causes a compromised immune system. Exposure to opportunistic microbes with this condition can lead to severe infection and is most often the cause of death. These infections often originate in the oral cavity and should be of great concern to dental personnel. HIV is much less infectious than Hepatitis B and C but due to the mortality rate, dental personnel should exercise extreme caution regarding it.

Human papillomavirus (HPV), primarily types 6 or 11, may rarely result in Recurrent Respiratory Papillomatosis (RRP). This disease is characterized by recurrent papillomas or warts in the upper respiratory tract, specifically the larynx. The disease is divided into two groups based on age of onset: juvenile (<18 years) onset (JORRP) and adult onset (AORRP). JORRP is much more common and is thought to be transmitted to the baby during delivery from mothers with genital warts, with a median age of diagnosis of 4 years. JORRP is associated with extensive morbidity (9). Estimates of its incidence are imprecise but range from 0.4 to 1.1 cases per 100,000 live births to women with a history of genital

warts (2). HPV is primarily spread through sexual contact, but the presence of RRP in the respiratory tract makes it a potential risk to dental hygienists performing dental procedures in the oral cavity.

1.3.2 Saliva-droplet and Direct Contact

Herpes simplex viruses (HSV-1, HSV-2) cause recurrent labial and genital herpes, herpetic whitlow and keratitis (21). HSV is a medium-sized lipid-enveloped virus and is classified in the same category of microbial resistance to germicidal agents as HIV (4). Its particular hazard for dental personnel is due to its common occurrence, high infectivity and asymptomatic state during which the virus has been found in saliva (21).

SARS (SCoV) – the virus that causes severe acute respiratory syndrome (SARS) – is a virulent coronavirus containing RNA. Because it is a relatively new virus, health care personnel are particularly at risk. This was especially shown to be true during a 2002 epidemic of the virus in which more than 25% of those affected were healthcare workers (21).

Other viruses of particular interest with the saliva-borne and direct contact routes include: adenoviruses, coronaviruses, cytomegalovirus (CMV), Epstein-Barr virus (EBV), human herpesviruses type 6-8 (HHV-6, HHV-7, HHV-8), varicella-zoster virus (VZV), influenza virus (type A, B, C), measles virus, parotitis virus, parainfluenza viruses (type 1-4), RS virus (RSV), human parvovirus (B19), coxsackie virus (A21), echo viruses 6 and 20, polio virus, other enteroviruses, rhinoviruses, reoviruses, and rubella virus (21).

Mycobacterium tuberculosis (TB) is carried in droplet nuclei released by individuals with pulmonary or laryngeal tuberculosis disease by coughing, talking, sneezing, etc. (7). Because Tuberculosis is transmitted via the air, there is risk of dental hygienists inhaling TB-contaminated aerosols during dental procedures and becoming infected.

Other bacteria. It is well known that dental plaque, tooth decay and periodontal disease are caused by bacteria. By some estimates, there can be nearly 300-400 species of bacteria in the oral cavity

and “one drop of saliva may contain nearly 50,000 bacteria, belonging to 25 genera” (21). The danger is that many of these bacteria are potentially pathogenic. They can be divided into aerobic and facultative anaerobic species and anaerobic species. Aerobic and facultative anaerobic bacteria include: gram-negative rods (*Escherichia coli, Bordetella pertussis*), gram-negative diplococci, gram-positive rods (*C. diphteriae*, diptheroids), staphylococci, streptococci, spirochetes, and mycoplasmas. Anaerobic bacteria include: gram-negative rods (*Porphyromonas gingivalis*), gram-positive rods, streptococci, spore-forming rods, and actinomycetes (21).

Anaerobic bacteria and facultative anaerobic bacteria are the main causes for periodontitis. These include specifically *Porphyromonas gingivalis, Prevotellaintermedia, Peptostreptococcus micros, Actinobacillus actinomycetemcomitans* and *Campylobacter rectus* (21). Many potentially pathogenic bacteria are carried into the nasopharynx region of the oral cavity. These bacteria can easily move into the oral cavity, mix with saliva, and be released into the breathing area of dental personnel.

Fungi, typically from the *Candida* genus, and **protozoa**, such as *Pneumocystis carinii*, can also be transmitted via the saliva-droplet mode. *Candida* spp. is very common in the oral cavity, especially amongst denture wearers. The protozoa are less common, but can be a problem with immunocompromised individuals (21).

1.3.3 Water-droplet

Biofilm. The earliest recognition of the concept of a biofilm was documented by the 17th century by Antonie van Leeuwenhock, who was able to visualize bacteria from plaque on his teeth (8). Since then, the definition and understanding of a biofilm has changed and grown extensively. A biofilm may be thoroughly defined as a sessile community of microorganisms irreversibly attached to a surface and to each other, producing and embedded in a matrix of extracellular polymeric substances (EPS), and exhibiting altered phenotypic properties, particularly with respect to gene transcription and growth rate (3, 8, 18, 21). Because of its well-organized biostructure, a biofilm can be compared in many ways to the

tissues of higher organisms. Biofilms display an easy exchange of genetic material and absorption of nutrients from the surrounding water, and a high resistance to antimicrobial substances and physical disturbances (18, 21).

When a solid surface is immersed in an aquatic environment, organic and inorganic nutrients in the water immediately begin to adsorb onto the surface to form a conditioning film. The film alters the surface to improve the efficacy of subsequent bacterial adhesion. Through both active and passive processes, involving EPS, a reversible attachment and eventually an irreversible attachment forms (Figure 1). Irreversible adhesion is achieved through the secretion of EPS and subsequent microbial multiplication. Mature biofilms may contain bacteria, fungi and parasitic organisms (18).

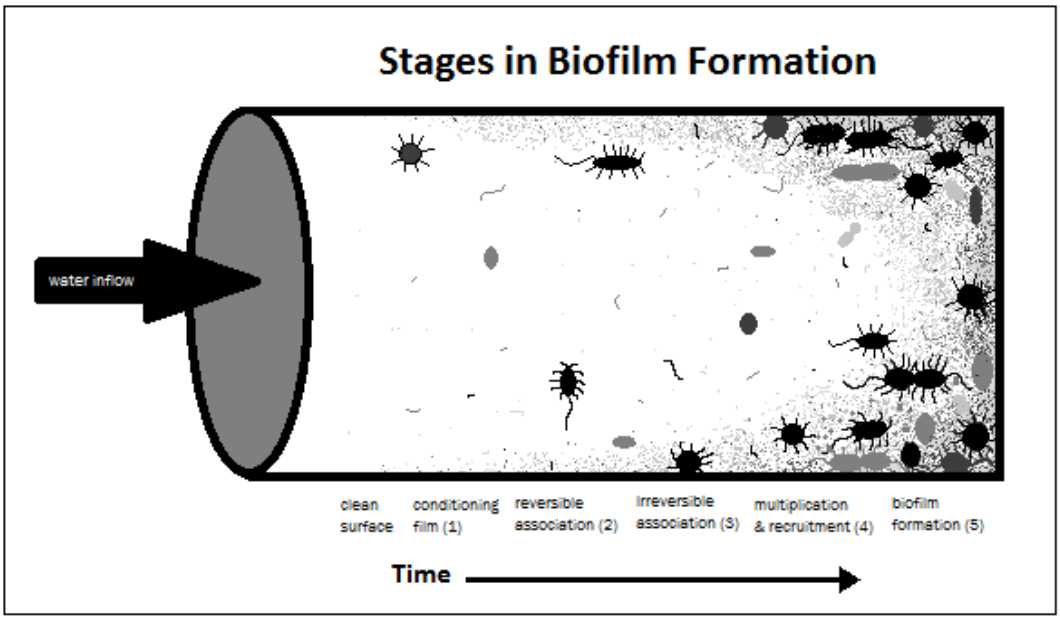

Figure 1 – The Progressive Stages of Biofilm Formation

Dental unit water lines (DUWL) supply water to multiple hand pieces including the air-water syringe, the ultrasonic scaler, and the high-speed hand piece (3). This water is typically used to not only flush the patient's mouth but also to cool handpieces and the patient's teeth during procedures. The DUWL may be supplied by either a municipal water line or a special reservoir connected to a unit, which may contain either distilled or sterile water (3, 21).

The microbore flexible tubing used in DUWL is the perfect environment for microbial colonization and proliferation because of the physics of laminar flow passing through the waterlines. This design results in maximum flow at the center and minimal flow at the periphery that enhances deposition of organisms onto the surface of the tubing. The intermittent use of DUWL, which include extended periods of stagnation (nights, weekends), further promotes microbial proliferation (14, 18). Contrary to popular belief, smooth and rough surfaces are colonized by bacterial strains to the same extent. Furthermore, it is whether a biofilm is formed in a low-shear or high-shear environment that determines its strength and resistance to mechanical breakage with the latter showing markedly greater durability (3). Microbial contamination of DUWL may come from 3 sources: primary contamination of municipal water, a patient's saliva retracting in the waterlines or dental hand pieces, and biofilms within the tubing system of the dental unit (21). However, the formation and sloughing off of biofilms is the most important and abundant cause of DUWL contamination (21).

In 2000, the American Dental Association issued a recommendation that DUWL should comply with potable/drinking water standards and therefore contain no more than 200 CFU/ml of aerobic bacteria (14). Nevertheless, contaminated water with elevated bacterial counts has been recovered from DUWL (3). Although there is no evidence of widespread public health problems being linked to DUWL, a few cases of infection in patients related to dental work have been reported. Because DUW may be ingested, inhaled as an aerosol, or directly contaminate open wounds in or surrounding the oral cavity (14), the goal should always be to reduce the risk of exposure to the dental personnel and the patient as much as possible.

In some instances, bacterial counts exceeding 10^5 CFUs/ml have been reported in DUWL (8). Most of these microorganisms comprising DUWL biofilms are harmless, some of which include: *Moraxella* spp.*, Flavobacterium* spp.*, Micrococcus* spp.*,* and *Actinomyces* spp. (8).

Biofilms originating from hospital settings have been studied much more than those from dental settings. Hospital waterlines in most cases are much more extensive than dental waterlines; however, the survival and infectiousness of pathogens recovered from these settings are relevant and applicable to the dental setting. There are three genera that have done especially well at being causative agents of waterborne nosocomial (hospital-acquired) infection: *Pseudomonas* spp. *(P. aeruginosa* in particular*), Mycobacteria* spp., and *Legionella* spp. (18). These three are also the major focus of infection control with regard to DUWL. These three are respiratory pathogens capable of proliferating in the biofilm and reaching infective concentrations with potential for inhalation via aerosols or direct contamination (18). A more thorough list of microorganisms typically isolated from DUWL is shown in Table 1 (14).

Table 1 – Microorganisms Commonly Recovered from Dental Unit Water Lines

Microorganisms Commonly Recovered from Dental Unit Water Lines		
Bacteria	**Fungi**	**Protozoa**
Achromobacterxyloxidans	*Alternariaspp*	*Acanthomoebaspp*
Acinetobacterspp	*Cladosporiumspp*	*Cryptosporidium spp*
Actinomycesspp	*Penicilliumspp*	*Giardia spp*
Alicaligenesdentrificans	*Phomaspp*	*Microsporidiumspp*
Bacillus spp	*Scopulariopsisspp*	
Bacteriodesspp		
Burkholderiacepacia		
Caulobacterspp		
Flavobacteriumspp		
Fusobacteriumspp		
Klebsiellapnuemoniae		
Lactobacillus spp		
Legionella pneumophila		
Legionella spp		
Micrococcus spp		
Moraxella spp		
Mycobacterium avium		
Mycobacterium spp		
Nocardiaspp		
Pasteurellaspp		
Proteus vulgaris		
Pseudomonas aeruginosa		
Staphylococcus aureus		
Streptococcus spp		
Xanthomonasspp		

Mycobacteria not classified as *Mycobacterium tuberculosis* or *M. leprae* are generally referred to as non-tuberculosis *Mycobacterium spp*. (NTM). Many NTM are still pathogenic and can cause pneumonia, cutaneous, and disseminated disease. These organisms typically originate from environmental sources such as drinking water and spread via ingestion, inhalation, or inoculation (13). NTM has been isolated from nearly 50% of municipal water lines in low numbers. Fortunately, most NTM infection is asymptomatic and studies have suggested that approximately 12% of the US population has been colonized by NTM, *M. avium* (13, 15). Only a small number of studies have been conducted which evaluate the risk of NTM from DUWL (13, 15). NTM are commonly isolated from DUWL and have been shown to proliferate in the biofilm (15). These studies found that the numbers of NTM in the DUWL exceeded that in the drinking water by a factor of 400 (15). The clear concern is that large numbers of NTM could be inhaled, swallowed or inoculated during dental procedures with the potential to infect the patient or dental personnel. Furthermore, gargling with water contaminated with NTM resulted in respiratory colonization (13, 15). While bolus doses of NTM could obviously be hazardous to dental personnel, chronic low-level exposure may have a positive effect on dental personnel by priming the immune system to NTM and increasing resistance to these pathogenic microorganisms (13).

***Legionella* spp.** are gram-negative rods which are ubiquitous in the environment and can be found in all types of water, generally in low numbers. Within the DUWL biofilm, *Legionella* spp. replicate intracellularly in amoebae (13). This intracellular growth provides nutrients and protection against biocides, physical agitations and temperature changes. In the DUWL, extended periods of stagnant water, low chloride concentrations and an average water temperature of 23°C all contribute to the proliferation of *Legionella* spp. (21). Under suitable conditions, legionellae can be amplified in the DUWL biofilm reaching concentrations in the range of 10^2 to 10^5 CFU/ml (13). Once established, this colonization can persist for years (13). One study detected *Legionella* spp. in 68% of the DUW samples and *L. pneumophila*, the strain typically responsible for Legionnaire's disease, in 8% of the samples (14).

Legionella spp. are the causative agent in both Legionnaire's disease, a fatal pneumonia, and Pontiac fever, an influenza-like illness. There are 48 species of Legionella and more than 51 serogroups that have been identified. Contaminated water has been identified as the environmental source of nearly all *Legionella* spp. infections (18). Although the overall number of cases may be underestimated, approximately 360 cases of Legionnaires' disease occur in the United States each year with a fatality rate of 12%. The rates tend to be higher in cases of nosocomial infection and amongst those who are immunocompromised (13).

Transmission of *Legionella* spp. occurs via inhalation of infected/contaminated aerosols or direct inoculation of open wounds. Because a large number of aerosols are produced during dental procedures utilizing high-speed handpieces, DUWL are a potential source of exposure to *Legionella* spp. (1). While there have been many reported cases of *Legionella* spp. infection originating from hospital waterlines, there are no known patient cases of *Legionella* spp. infections originating from DUWL. Nevertheless, proper dental and sterilization techniques should be practiced by all dental personnel to minimize the possibility of exposure and infection of *Legionella* spp. to the patient and the dental staff. Although a dentist was reported to have died from *Legionella* spp., there is no conclusive evidence that the infection developed from the DUWL (13). While the patient typically only faces a possible one-time exposure to legionella, the risk of exposure posed to the dental staff is significant due to sustained and daily contact with DUWL aerosols (15). Dental staff with underlying disease or on drug therapy regimens may have increased susceptibility to infection. Studies have demonstrated increased prevalence of respiratory infections amongst dental personnel compared to the general public and other medical workers (14). Dental personnel have been reported to have higher rates of positive serological reactions to Legionella antigens (21), higher seroprevalence rates for Legionella antibodies (18), higher rates of seropositivity for Legionella (13), and/or higher titres of Legionella antibodies (15, 27) compared to the general population. Furthermore, the magnitude of Legionella antibody titres correlated directly with

the duration of time spent carrying out clinical work (14). Another study also showed a strong correlation between Legionella-seropositive individuals and the degree to which these individuals were exposed to aerosols from high-speed drills and air-water syringes (1). Thirty-four percent of the sample group showed a positive reaction for antibodies to *L. pneumophila*, compared with only 5% testing positive in a control group of nonmedical workers (1). From amongst those sampled, dentists had the highest prevalence (50%) of *L. pneumophila* antibodies, followed by dental assistants (38%) and technicians (20%) (1). All of this suggests that dental personnel are at an increased risk of *Legionella* spp. exposure, and that aerosols generated from the DUWL during dental procedures are the likely source (1, 14).

Pseudomonas aeruginosa. Pseudomonas and related species constitute the majority of bacterial genera present in DUWL*. P. aeruginosa* is one such pathogenic species which accounts for 9-11% of nosocomial infections reported each year in the United States and Europe, specifically amongst the immunocompromised (13). It can thrive in low-nutrient environments, including distilled water, which is routinely used by dentists in DUWL utilizing reservoirs. It can grow in dilute disinfectants and displays a range of antibiotic resistance. DUWL are commonly found to be colonized with *P. aeruginosa,* and it has been isolated from nearly 50% of DUWL (13).

The first step in *P. aeruginosa* infections is colonization of the gut. The infectious dose for *P. aeruginosa* is > 1.5 X 10^6 CFU/ml (13), but high doses like this are rarely encountered in a DUWL and so the estimated risk of becoming colonized from exposure is very low. As with Legionella, immunocompromised individuals, or people taking certain drug therapies such as antibiotics are more susceptible and require a lower infectious dose. There are a few studies documenting infection resulting from *P. aeruginosa* originating in DUWL. In a 1987 study, two patients with cancer were exposed to a DUWL contaminated with *P. aeruginosa* (13). Both patients then developed gingival abscesses from which *P. aeruginosa* was isolated using pyocin-typing. The *P. aeruginosa* pyocin-type strain isolated from

the patients was also isolated from the air turbine of the DUWL. Although the pyocin-typing method was used often in 1987, this method has low discriminatory power and therefore having isolates with the same pyocin type does not indicate the same strain. DNA fingerprinting would be required for that, and so although the 1987 study is noteworthy, its results are not conclusive that the two patients did indeed acquire *P. aeruginosa* from the DUWL.

Pseudomonas spp. are also of concern because of their remarkable resistance to antibacterials, germicides, biocides, etc. A number of reports demonstrate the survival of *Pseudomonas* spp. in preparations of germicides during their manufacture. One microbial contamination of iodophor antiseptic solutions during manufacture is associated with a subsequent outbreak of nosocomial infection (18). In another case, waterlines highly contaminated with biofilm were found to be the origin of a *P. aeruginosa*-contaminated poloxamer-iodine antiseptic which was concluded to be the cause of peritoneal infections. And finally, in another case of nosocomial infection, *P. multivorans* was isolated from infected surgical wounds of 9 patients (18). *P. multivorans* was later cultured from bottles of topical antiseptic used to clean the wounds. It was determined that the source of contamination was the piped water supply used to dilute the antiseptic concentrate (18).

Although the risk of acquiring an infective dose via a DUWL appears to be very low, because of its abundance within most DUWL biofilms and its amazing antibacterial resistance to biocides, *Pseudomonas* spp. and *P. aeruginosa* in particular should be microorganisms of concern to all dental personnel and dental offices.

Gram-negative bacteria. The majority of Gram-negative bacteria found in DUWL are non-pathogenic. Nevertheless, they are still sources of concern because the bacterial cell wall of Gram-negative bacteria is a potent source of endotoxin, which can cause localized inflammation, fever and shock. Furthermore, these Gram-negative bacteria, the endotoxins they produce as well as fungal

pathogens, which can be transported in indoor environments via dust and water aerosols, are known triggers of allergic and non-allergic asthma in susceptible individuals (13).

1.4 Plaque

Biofilm develops on tooth surfaces within the mouth in much the same way as described with regards to DUWL. Just as with other areas of the body, the mouth has its own unique microflora composition, which varies on the tooth depending on the exact location, i.e. fissures, gingival crevice, etc. The main microflora at any given location benefits the host by helping to prevent colonization by exogenous microbes (10). Members of the genera *Streptococcus, Actinomyces, Haemophilus, Neisseria*, and *Veillonella* are often "early colonizers" of the tooth surface. Once established, the microflora stays relatively stable over time through a dynamic balance of synergistic and antagonistic microbial interactions (10). This stability is referred to as microbial homeostasis. Unless it is removed by meticulous oral hygiene, once the biofilm is established, plaque accumulates specifically at stagnant or retentive sites. The natural protective and penetrative qualities of saliva are less effective as the mass of plaque increases. Microbial homeostasis can break down (10), and there can be dramatic shifts in the composition of the microflora.

The accumulation of plaque associated with the gingival margin leads to gingivitis. In response to this microbial challenge, the host increases the flow of gingival crevicular fluid (GCF). Furthermore, "the composition of subgingival plaque shifts away from a streptococci-dominated microflora to one with higher levels of *Actinomyces* spp. and an increase in capnophilic and obligatory anaerobic bacteria such as *Capnocytophaga, Fusobacterium*, and *Prevotella* spp. (10). The progression of gingivitis can lead to more advanced forms of periodontal disease, in which the microflora can become even more diverse (10)."

The presence of hardened calculus in the form of plaque and the pathogenic microorganisms with the development of gingivitis and other periodontal diseases present a two-fold threat with regards

to dental hygiene procedures. The aerosolization of each increases the potential risk of upper respiratory infections in patients and dental personnel exposed to them.

1.5 Ultrasonic Scalers

Multiple studies have concluded that of all the dental instruments typically used, ultrasonic scalers produce the largest amounts of contaminated aerosols. The reason for this increased amount is a simple matter of mechanics. Ultrasonic scalers operate by utilizing a transducer to create a frequency vibration ranging from 25,000Hz to 42,000Hz (5). The vibration is transformed into mechanical energy at the scaler's tip which allows for plaque removal. In order for the scaler to vibrate at the correct frequency, water is necessary during operation. The necessity of the water for proper instrument operation essentially ensures the production of dental aerosols. These aerosols, which may be infected from the patient's oral cavity and/or the DUWL have the potential to contaminate the immediate environment. While all ultrasonic scalers function in essentially the same manner as described above, there is some variation amongst the transducers (piezoelectric vs. magnetostrictive), the delivery method of the water (focused vs. other methods) and the shape of the scaler tip (slim vs. standard).

A 1998 study revealed that even without the use of coolant water, ultrasonic scalers still produce significant amounts of aerosols compared to hand scaling (5). Furthermore, these aerosols traveled a distance of at least 18 inches from the site of operation (5), which is well within the distance that a dental hygienist is typically working. Another study from 2006 showed significant contamination at all distances ranging from 0.5-2 meters from the operative site (17). Contamination levels in rooms where high speed and ultrasonic instruments were used were compared to those rooms where procedures were done without high speed instruments. The rooms with high speed instruments showed significantly increased contamination levels (17).

1.6 Particulate Matter

At the present time there are no indoor air quality standards in the United States. A few state and/or local organizations have issued guidelines but none that hold the penalty of law. This lack of state or federal indoor air quality control standards provides no assurance to the public (and dental staff) who assume areas they enter for dental procedures are safe. Instead each hospital or dental office is simply encouraged to follow basic principles of infection control.

The Environmental Protection Agency (EPA), through the Clean Air Act, has set National Ambient Air Quality Standards (NAAQS). These standards were created for six principal pollutants considered harmful to public health and the environment, including particulate matter (Table 2). Primary standards are put in place to protect public health, including sensitive populations. Secondary standards protect public welfare, which includes visibility, damage to animals, crops, vegetation and buildings (25). It is important to note these standards address outdoor air quality, not indoor air quality. Therefore, they serve little application for the indoor dental setting.

Table 2 – The National Ambient Air Quality Standards (NAAQS) for Particulate Matter

National Ambient Air Quality Standards				
	Primary Standards		**Secondary Standards**	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Particulate Matter (PM_{10})	150 $\mu g/m^3$	24-hour	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual (Arithmetic Average)	Same as Primary	
	35.0 $\mu g/m^3$			

The EPA admits that particulate matter is of concern to public health, especially if those particulates are from hazardous materials such as asbestos, heavy metals, etc. Furthermore, particulate matter <10µm in diameter and definitely those <2.5µm carry the risk of being respiratory irritants regardless of whether they carry infectious agents or not. Therefore, high concentrations of particulates <10µm in diameter should also be an issue to public health indoors. The dental clinic may just be an environment that harbors high levels of these small particulates during dental procedures.

1.7 Summary

The abundant production of aerosols during dental procedures and the fact that dental personnel experience higher rates of respiratory infections compared to the general public and their medical colleagues has led to speculation that aerosols may be directly responsible for their increased risk of infection. The purpose of this study was to try and determine if dental hygienists specifically were at an increased risk for upper respiratory infections due to hazards experienced during the performance of their job. Although some work has been published on the potential spread of bacterial contamination in the dental clinic, the quantitative analysis of particulates and aerosols produced by selected dental procedures has not been reported.

Previous studies concluded that ultrasonic scalers produce the greatest amount of contaminated aerosols (5). The basic action of the scaler removes plaque and potentially opens gingival pockets along the gum line both of which could harbor pathogenic microbes. Potentially contaminated aerosols produced during scaling can remain suspended. If dental hygienists remove their protective barriers during this suspension time, they may be exposed.

Therefore, focus was given to the ultrasonic scaler to determine if there are significant and sustained increases in particulate counts during its use, which could possibly increase the dental hygienist's risk to infection. In order to quantitatively measure particulates, an indoor air quality monitor was placed in individual dental cubicles during dental hygiene procedures. The monitor remained on for the duration of each appointment measuring changes in particulate counts.

CHAPTER 2: MATERIALS AND METHODS

2.1 Clinic and Survey Location

This study was conducted in the Dental Hygiene Student Clinic of the Louisiana State University School of Dentistry in New Orleans, Louisiana, from the fall of 2009 through the spring of 2010. The dental hygiene program is a two year program, consisting of 1st and 2nd year students. During the 2009-2010 school year, the 1st year class had 28 students and the 2nd year class had 30 students.

2.2 Dental Personnel

This study aimed to evaluate the potential risk of infection in dental hygienists, in direct correlation to the dental procedures they perform. Dental hygienists do not perform all of the procedures dentists perform; however, the nature of their work and their proximity to the patient is comparable to a dentist. For the purpose of this study, any risk associated with general dentistry work has been assumed to also apply to dental hygienists as well. Therefore, any reference made to dental personnel in the present study, includes dental hygienists, dentists, dental surgeons, and dental assistants.

2.3 Clinic Equipment

The Met One Instruments Model 212-2 Ambient Particulate Profiler was used to monitor clinic indoor air. This instrument uses a laser-diode based optical sensor and light scatter technology to detect, size and count particles, including both aerosols and particulates (11); it does not, however, distinguish between these particle types. The data was calculated and downloaded through a serial cable to a Dell laptop computer and, using the software provided by Met One, was automatically saved and graphed to Microsoft Excel. For each 60 second interval, the monitor produced a data line which included the time, particulate count for each particle size, flow rate, relative humidity and temperature. For the duration of the sessions, the flow rate was set at 3.0 LPM (liters per minute) for all data

collections except for one morning session on 2/11/10 in which the flow was 1.9 LPM. The detection range for the monitor is 0.3µm to 10µm (Table 3).

Table 3 – Technical Specifications for the Met One Instruments Model 212-2 Ambient Particulate Profiler

Met One Instruments Model 212-2 Ambient Particulate Profiler Specifications	
Measurement Principle	Optical, Light-Scatter using a Laser Diode
Flow Rate Range	0.0 LPM to 5.0 LPM
Measuring Range	0.3µm to 10µm
Concentration	0 – 9,000,000 Particles per cubic foot
Sample Flow Rate	3.0 LPM
Sample Interval	1 – 60 seconds
Accuracy	+/- 10% to calibration aerosol
Temperature	0 to +40 degrees Celsius
Weight	3 lb.
Size	Diameter 4.0 in, Length 7.5 in + 12” for inlet tube

2.4 Survey Background

The survey for this study was originally constructed in a previous study by Master of Public Health candidates/researchers Chase Villeret and Anna Wanko under the direction of Dr. James Diaz of the Louisiana State University School of Public Health in New Orleans, Louisiana. An IRB was obtained for this previous study, which remained valid for the present study (Appendix A). Only a few minor changes were made to the survey from the original, specifically with spacing and dates. A copy of the survey can be found here (Appendix B).

2.5 Clinic Air Sampling

Each day the clinic is comprised of both morning and afternoon sessions with 3 hours allotted for each. Morning sessions begin at 9am and end at 12 noon. There is a one hour lunch break. The afternoon session begins at 1pm. Each dental hygiene student may have a maximum of two patients per day. Each student is assigned one cubicle but each may not have patients. During any session, about one-third of the students act as assistants to the other students who do have patients. These assistants may gather instruments, help set up equipment, enter information into the computer, and assist in

cleanup of the cubicle. The Dental Hygiene Instructors and assistants comprise the majority of the foot-traffic in the aisles during a session.

Prior to each session, a dental hygiene student who scheduled to use the ultrasonic scaler on a patient was chosen to monitor. The air monitor was placed in their cubicle. If no student had scheduled ultrasonic scaler use, the cubicle was chosen at random. The air monitor was placed in line with the headrest of the patient chair, ~ 26" from the aisle, 8" from the edge of the counter and on top of a plastic container approximately 2" thick (Figure 2). The top of the monitor extended nearly 6" above the half-wall partitions between each cubicle. The air monitor was connected to the laptop, which assured the unit was functioning properly, actively monitoring and recording the measurements.

Figure 2 – Met One Air Monitor assembled for data collection on cubicle counter in the Dental Hygiene Clinic at the LSU School of Dentistry.

While the dental hygiene student was with the patient, the clinical activities and procedures, such as oral examination of the teeth, ultrasonic scaler use, sink use, polishing of the teeth, etc., were observed and recorded. The air monitor remained in operation until the dental hygiene student completed all procedures on the patient and cleaned the cubicle.

Throughout the appointment, the instructors monitored the progress of the dental hygiene student's work to insure proper technique and all guidelines were being followed before proceeding to the next phase of the appointment. Upon entering the cubicle, instructors routinely used the sink. In order to monitor the student, instructors often examined the procedures performed on the patient and recorded this information on the patient's chart in the cubicle or on the cubicle wall. They also checked each student's computer to validate the correct information had been entered regarding the patient and procedures performed.

There are two models of ultrasonic scalers utilized by dental hygiene students in the clinic. These include the Dentsply Cavitron Plus Extended SPS Technology (cavitron) and the Suprasson Lux Newton (piezoelectric). The Cavitron model was used in all of the cubicles where the air monitor was placed. Within this document and in the researcher's notes the word "cavitron" and ultrasonic scaler have been used synonymously.

2.6 Survey Methods

Surveys were given to first and second year dental hygiene students on two separate occasions. The survey addressed typical demographic information such as age, sex, health history, etc. The main questions addressed clinical duration time and the incidence of respiratory symptoms. Second year students completed additional questions regarding dental hygiene methods and practices in the clinic. The goal of the survey was to determine if any factors, both basic and specific to dental hygiene practices, affected the likelihood of students experiencing symptoms of upper respiratory infection. Statistics were conducted on the survey data to determine this.

2.7 Air Monitor Analysis

Raw air monitor data was compared in Microsoft Excel to notes taken by the researcher during data collection (For example, see Figure 3). Instances of ultrasonic scaling of significant duration (5+ minutes) were isolated for further study (For example, see Figure 4). The particle counts for the 1st 3-5 minutes were averaged and designated Baseline (BL). After the Baseline, the counts for the first 3-5 minutes with a noticeable peak in particle counts were designated Initial Cavitron (IC). The final designation, referred to as Total Cavitron (TC), included the counts from the Initial Cavitron through the duration of ultrasonic scaling or until there was a noticeable drop in the particle counts. After establishing these categories - Baseline, Initial Cavitron and Total Cavitron - the data was further analyzed in Microsoft Excel and statistically using the SAS program (PROC MIXED, PROC GLM, PROC UNIVARIATE AND PROC MEANS).

2.8 Survey Analysis

Data from the surveys was initially entered into Microsoft Excel and later analyzed statistically using the SAS program (PROC LOGISTIC and PROC FREQ).

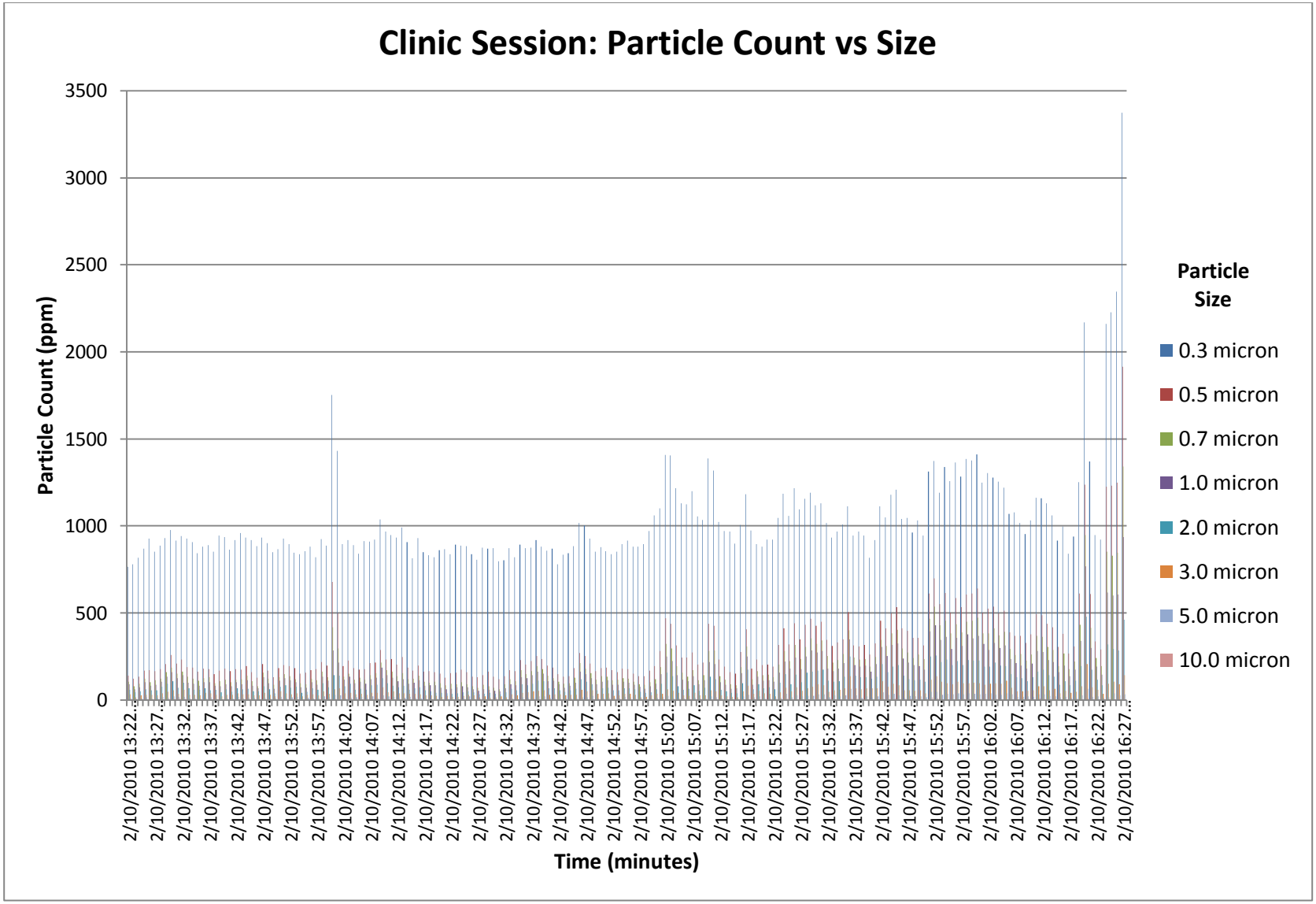

Figure 3 – Raw Air Monitor Data for Entire Clinic Appointment (Afternoon 2/10/2010); Particle Count versus Time

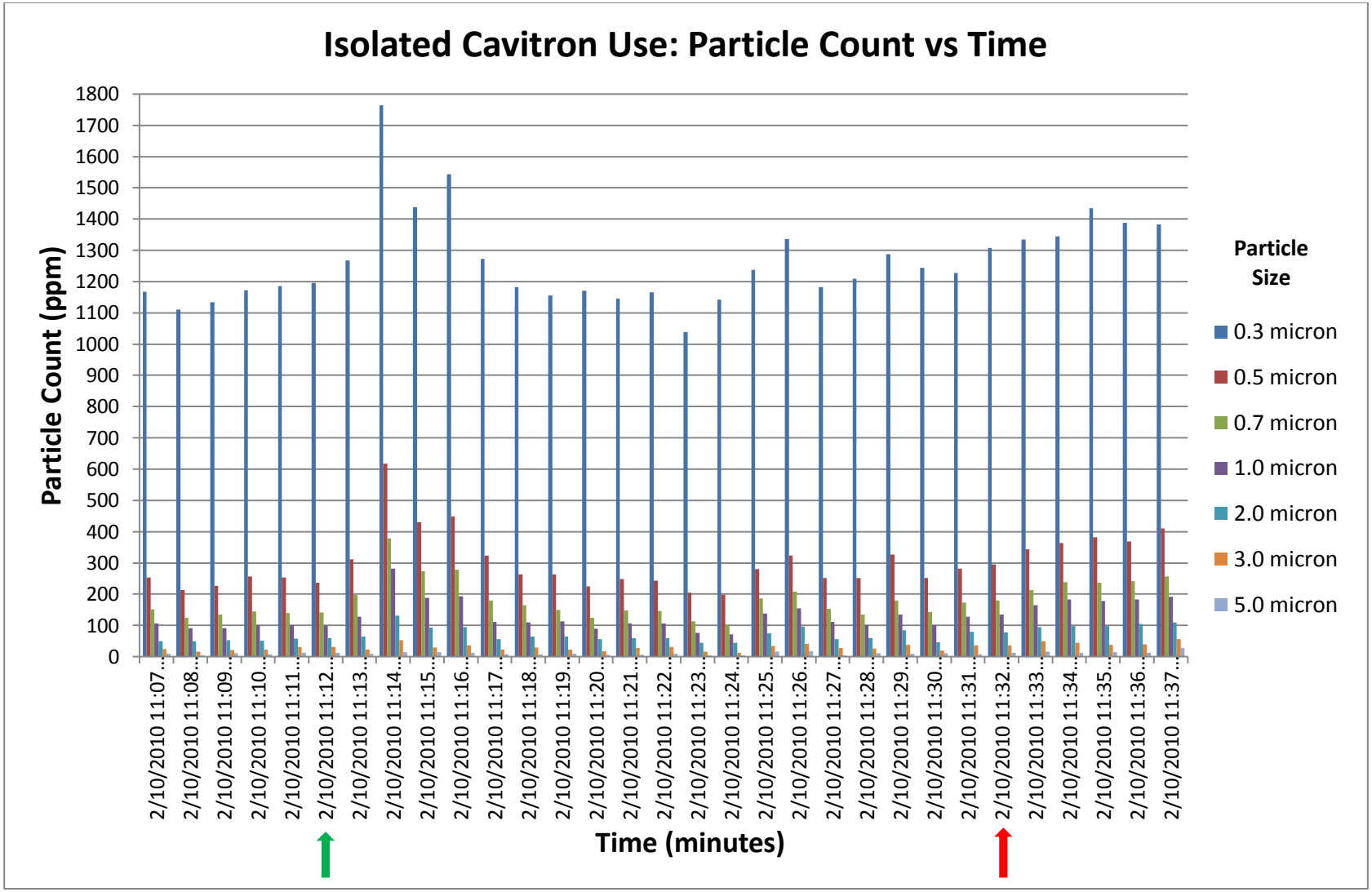

Figure 4 – Isolated Cavitron (ultrasonic scaling) Use (Morning 2/10/2010); Particle Count versus Time; Green Arrow indicates start of cavitron use; Red Arrow indicates end of cavitron use

CHAPTER 3: RESULTS

3.1 Data Collection

Numerous visits to the LSU School of Dentistry's dental hygiene clinic were conducted over several months to monitor air particulate levels during standard dental hygiene procedures. Clearly delineated spikes in particulate count were observed with ultrasonic scaling use in only 6 out of 21 total instances. These six instances were analyzed for various aspects including: percent increase with Initial Cavitron peak, percent increase with Total Cavitron use, baseline variation with particle size, time from the ultrasonic scaling start to particulate count rise, and potential influence of background variables such as relative humidity and temperature on particulate count.

3.2 Percent Increase

An overall rise in the particulate count was observed with ultrasonic scaling. In 28.5% (6/21) of the samples collected, there were easily distinguishable peaks in particulate counts ranging in size from 0.3-5.0µm in diameter. For analysis, the particle counts for each category, Baseline (BL), Initial Cavitron (IC) and Total Cavitron (TC), were averaged for each size and instance of cavitron use (session). The percent difference between the Baseline and Initial Cavitron and between the Baseline and Total Cavitron were calculated (Table 4 and Figure 5). The means and standard deviations were also calculated (Table 4). The percent differences for all sessions were averaged for each size (Figure 6). The average percent increase due to the Initial Cavitron for each individual particle size was as follows: 0.3µm (29.8 ± 9.4%), 0.5µm (85.0 ± 13.2%), 0.7µm (90.0 ± 20.0%), 1.0µm (88.7 ± 25.2%), 2.0µm (80.5 ± 25.6%), 3.0µm (68.8 ± 31.5%) and 5.0µm (59.3 ± 42.3%). The average percent increase ranged from 29.8% to 90.0%. This data shows that the majority of the particles being produced during cavitron use are 0.5-2.0µm in size, especially 0.7µm and 1.0µm. These sizes are significant with respect to infectious agents, specifically bacteria (0.2µm-2.0µm) and viruses (0.07µm-0.4µm).

Table 4 - Initial Cavitron Percent Increase per Session

Size (µm)	02/10/10 (1)	02/10/10 (2)	02/10/10 (3)	02/11/10 (1)	02/25/10 (1)	03/10/10 (1)	AVG	STDEV
0.3	35	20	27	46	28	23	29.8	9.41
0.5	105	73	92	82	89	69	85.0	13.22
0.7	121	87	92	92	90	58	90.0	20.01
1	123	78	95	99	90	47	88.7	25.21
2	86	98	93	89	88	29	80.5	25.59
3	54	90	103	49	94	23	68.8	31.51
5	27	82	100	10	108	29	59.3	42.27

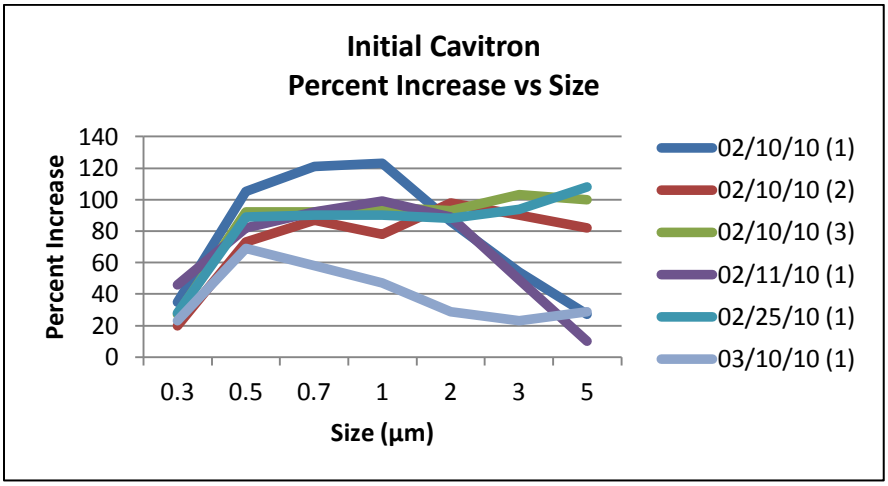

Figure 5 - Initial Cavitron Percent Increase versus Size

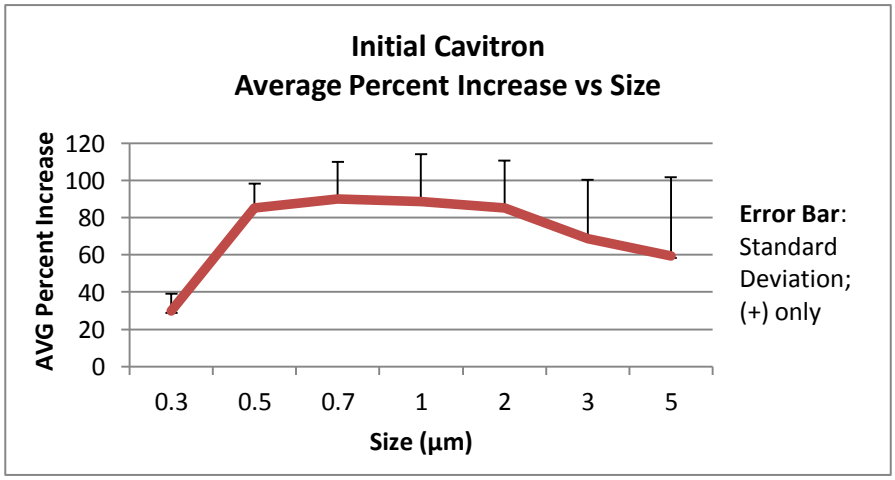

Figure 6 – Initial Cavitron Average Percent Increase versus Size

The average percent increases for the Total Cavitron use for each individual particle size were 0.3µm (20.5 ±9.8%), 0.5µm (59.5 ± 28.7%), 0.7µm (62.7 ± 30.1%), 1.0µm (62.7 ± 32.6%), 2.0µm (55.7 ± 34.0%), 3.0µm (48.3 ± 39.5%) and 5.0µm (50.5 ± 38.1%) (Table 5). A large variation in particulate count was noticeable between various sessions (Figure 7). The average percent increase for total cavitron use ranged from 20.5% to 62.7% (Figure 8).

Table 5 – Total Cavitron Percent Increase per Session

Size (µm)	02/10/10 (1)	02/10/10 (2)	02/10/10 (3)	02/11/10 (1)	02/25/10 (1)	03/10/10 (1)	AVG	STDEV
0.3	8	10	26	30	30	19	20.5	9.79
0.5	23	39	107	62	69	57	59.5	28.68
0.7	29	44	114	77	64	48	62.7	30.13
1	30	38	117	82	64	45	62.7	32.60
2	25	43	115	68	59	24	55.7	34.02
3	15	38	122	38	59	18	48.3	39.46
5	27	36	108	0	75	57	50.5	38.11

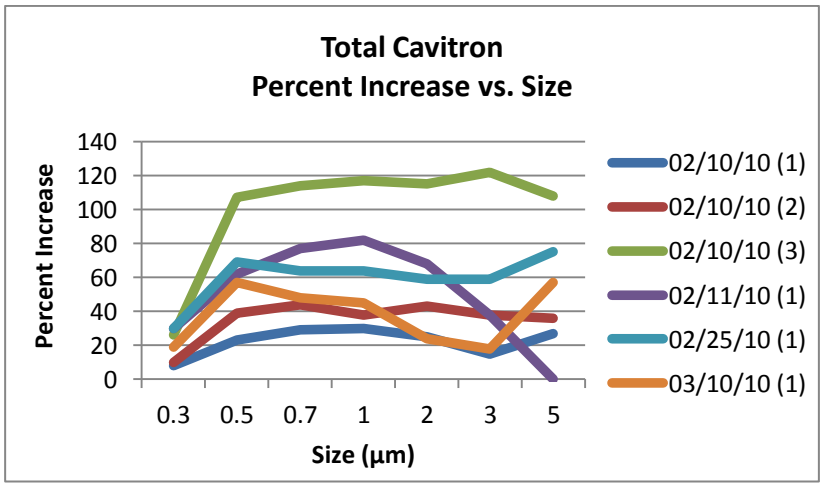

Figure 7 – Total Cavitron Percent Increase versus Size

This calculation of percent increase gives a picture of the particulate sizes being produced during ultrasonic scaling procedures. The 0.5µm, 0.7µm, and 1.0µm diameter particles show the greatest percent increases in particle count during ultrasonic scaling procedures. It is important to note that while these size particles exhibited the greatest percent increase in particle counts during ultrasonic

scaling, this does not indicate that these sizes had the greatest particle counts. Regardless of the time or procedure taking place, 0.3µm diameter particles always had the largest particle counts. However, while having the greatest number of particles, 0.3µm diameter particles also had very low variability.

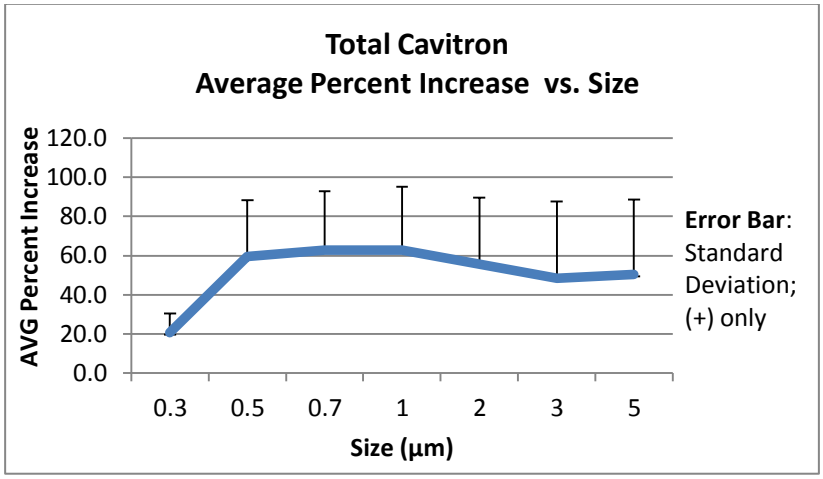

Figure 8 – Total Cavitron Average Percent Increase versus Size

3.3 Air Monitor Statistical Analysis

Statistical analysis on the air monitor data compared Initial Cavitron (IC) and Total Cavitron (TC) particle counts to the Baseline (BL) particle counts for each session. As averaged counts were already calculated for percent increase, they were used for the initial approach. This analysis revealed that the data follow an exponential regression model (Figure 9). The figure displays the inverse relationship between particle size and particle count, i.e. as size increases, particle count decreases in an exponential manner, which is nearly perfectly equal to 0.50. So for each size increase, the particle count drops by nearly 50% of the previous size's count. This is a rare relationship and implies that somewhere in the exponential regression equation, y=ae^{bx}, there is a constant.

Several statistical tests were run on the data from the air monitor to determine any significant effects. These tests included PROC MIXED, PROC GLM, PROC UNIVARIATE, and PROC MEANS. The test of PROC MIXED revealed significant effects of category (BL, IC, and TC) ($p=0.0006$) and size (particle size) ($p< 0.0001$) on particle counts (Table 6). PROC GLM analyzed the relationship between size and

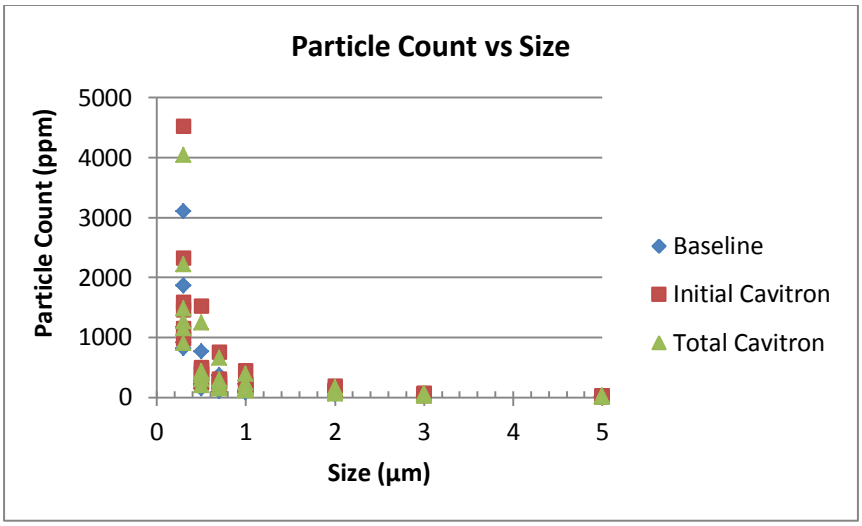

Figure 9 – Particle Count versus Size for each Category, Baseline, Initial Cavitron, and Total Cavitron

category (BL, IC, and TC) on particle count (Y). A model (Y=IX x CAT) was created for this test comparing the inverse of size (1/size = IX) to category. This model had an R-Square value of 0.505541, indicating this model explains ~50% of the variability in the particle count, or Y. This model had a significance level of p<0.0001 (Table 7). Because the inverse of size was used, this model also indicates that the data fit an exponential regression model.

Table 6 – The Fixed Effects from the First PROC MIXED Analysis displaying the significance of the variables Size and Category

Type 3 Tests of Fixed Effects				
Effect	Num DF	Den DF	F Value	Pr > F
CAT	2	102	7.91	0.0006
SIZE	1	102	596.69	<.0001
SIZE*CAT	2	102	0.27	0.7629

PROC UNIVARIATE was run on the residual error from the PROC MIXED analysis. This test assumes that the mean of the residuals is equal to zero. Based on the Shapiro-Wilk test of normality, the residuals are not normally distributed (p=0.0002). Therefore, the null is rejected (Table 8).

Table 7 – The R-Square and Model significance values from the PROC GLM Analysis

R-Square	CoeffVar	Root MSE	Y Mean
0.505541	90.70001	161.6392	178.2130

Source	DF	Type III SS	Mean Square	F Value	Pr > F
IX*CAT	3	6234902.864	2078300.955	79.55	<.0001

Table 8 – Significance level for the Shapiro-Wilk Test for Normality within the PROC UNIVARIATE Analysis

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.944075	Pr < W	0.0002
Kolmogorov-Smirnov	D	0.091195	Pr > D	0.0253
Cramer-von Mises	W-Sq	0.170005	Pr > W-Sq	0.0136
Anderson-Darling	A-Sq	1.183648	Pr > A-Sq	<0.0050

Recognizing previously that the data follow an exponential regression model, for a second PROC MIXED test, the natural log of the particle count (Y) was taken. This transformation reduced the variability of the data and revealed the data is approximately normal on a natural log scale. In this form, the variables, size and category (BL, IC and TC), were found to have significant effects on the particle counts. Furthermore, a significant increase in the particle counts for Initial Cavitron (IC) over Baseline (BL) was determined (p=0.0002). A significant increase in the particle counts for Total Cavitron (TC) over Baseline (BL) was also found (p=0.0063). This analysis also yielded an intercept and slope for BL (5.5502, -0.6485), IC (6.2217, -0.6973) and TC (6.0370, -0.6821) (Table 9). The slope and the antilog of the intercept were then used in an exponential regression equation (y=ae^bx) to graph the data (Figure 10). To better distinguish the significant increases in particle counts for IC over BL and in TC over BL, the natural log was again applied to the particle count (Y) (Figure 11). This figure also shows the trend in particle counts for BL, IC and TC across particle sizes. Figures 12, 13, and 14 show this for BL, IC and TC individually.

Table 9 – Solution for Fixed Effects with and without the Intercept displaying significant increases in IC and TC over BL as well as the slope and intercepts for BL, IC, and TC

Solution for Fixed Effects with Intercept						
Effect	**CAT**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
Intercept		5.5502	0.1234	102	44.99	<.0001
CAT	TC	0.4869	0.1745	102	2.79	0.0063
CAT	IC	0.6716	0.1745	102	3.85	0.0002
CAT	BL	0	.	.	.	.
SIZE		-0.6485	0.04793	102	-13.53	<.0001
SIZE*CAT	TC	-0.03362	0.06779	102	-0.50	0.6210
SIZE*CAT	IC	-0.04878	0.06779	102	-0.72	0.4734
SIZE*CAT	BL	0	.	.	.	.

Solution for Fixed Effects without Intercept						
Effect	**CAT**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
CAT	TC	6.0370	0.1234	102	48.94	<.0001
CAT	IC	6.2217	0.1234	102	50.44	<.0001
CAT	BL	5.5502	0.1234	102	44.99	<.0001
SIZE*CAT	TC	-0.6821	0.04793	102	-14.23	<.0001
SIZE*CAT	IC	-0.6973	0.04793	102	-14.55	<.0001
SIZE*CAT	BL	-0.6485	0.04793	102	-13.53	<.0001

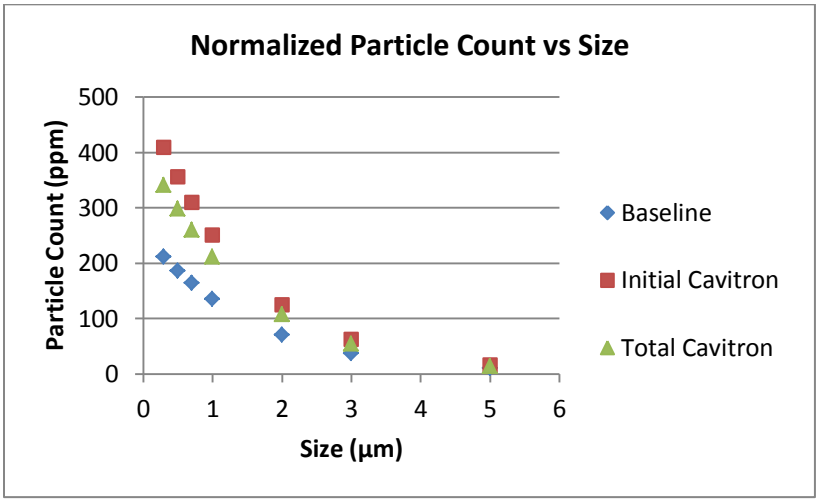

Figure 10 – Normalized Particle Count versus Size for each Category, Baseline, Initial Cavitron and Total Cavitron

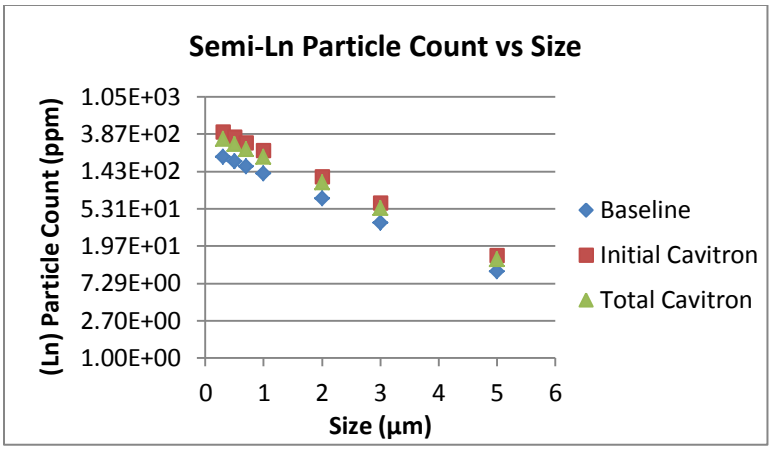

Figure 11 – Particle Count (Ln scale) versus Size for each Category, Baseline, Initial Cavitron, and Total Cavitron

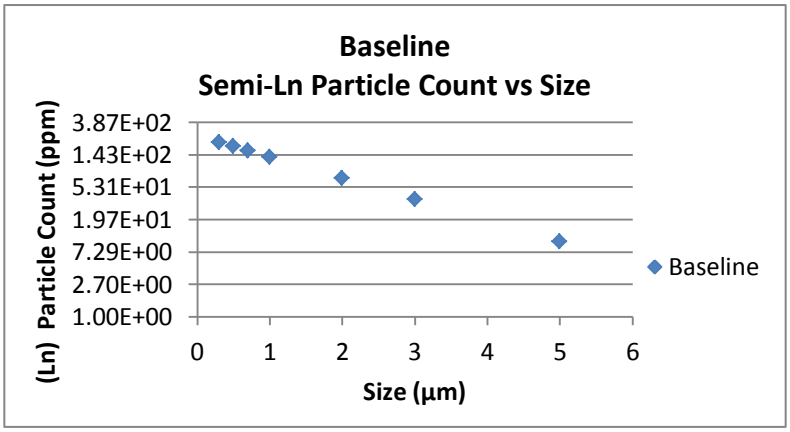

Figure 12 – Baseline Particle Count (Ln scale) versus Size

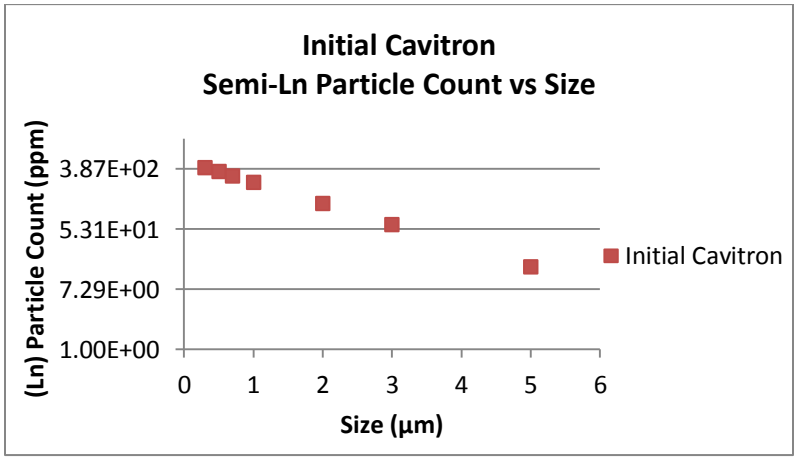

Figure 13 – Initial Cavitron Particle Count (Ln scale) versus Size

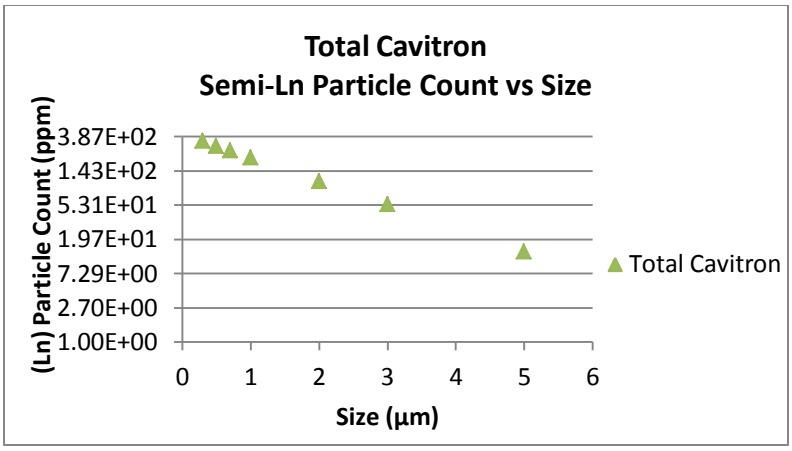

Figure 14 – Total Cavitron Particle Count (Ln scale) versus Particle Size

In order to isolate particle count differences between the BL, IC, and TC for sizes within sessions, a new variable, combining Date and Session, was established called Trial. Instead of using the averaged particle counts as in the previous analysis, the particle count for each minute was counted separately. Statistical analysis (PROC MEANS) of the variable Trial yielded the mean, standard deviation and 95% confidence interval for each particle size within each category for each session. The 95% confidence interval (CI) means that one can be 95% sure that the true population mean is within those limits (α=0.05). If the confidence intervals do not overlap then they are statistically different. By comparing the CIs, i.e. CI for 0.3 micron for BL to CI for 0.3 micron for IC for one trial, significant differences ($p<0.05$) in the particle counts of IC and TC compared to BL were determined (Table 10).

Table 10 – Significant Increases in Particle Counts for IC and TC over BL for Trials

Trial (Date & Session)	Size (µm)	Significant IC-BL	Significant TC-BL
02/10/10 (1)	0.3	-	-
02/10/10 (1)	0.5	-	-
02/10/10 (1)	0.7	X	X
02/10/10 (1)	1	-	-
02/10/10 (1)	2	-	-
02/10/10 (1)	3	-	-
02/10/10 (1)	5	-	-
02/10/10 (2)	0.3	-	-
02/10/10 (2)	0.5	-	-
02/10/10 (2)	0.7	-	-

Table 10 - Continued

Trial (Date & Session)	Size (µm)	Significant IC-BL	Significant TC-BL
02/10/10 (2)	1	-	-
02/10/10 (2)	2	-	-
02/10/10 (2)	3	-	-
02/10/10 (2)	5	-	-
02/10/10 (3)	0.3	-	X
02/10/10 (3)	0.5	X	X
02/10/10 (3)	0.7	-	X
02/10/10 (3)	1	X	X
02/10/10 (3)	2	-	X
02/10/10 (3)	3	-	X
02/10/10 (3)	5	-	X
02/10/10 (3)	0.3	-	-
02/11/10 (1)	0.5	-	-
02/11/10 (1)	0.7	X	-
02/11/10 (1)	1	X	X
02/11/10 (1)	2	X	X
02/11/10 (1)	3	-	-
02/11/10 (1)	5	-	-
02/25/10 (1)	0.3	-	X
02/25/10 (1)	0.5	-	-
02/25/10 (1)	0.7	-	-
02/25/10 (1)	1	-	X
02/25/10 (1)	2	-	X
02/25/10 (1)	3	-	-
02/25/10 (1)	5	-	-
03/10/10 (1)	0.3	-	X
03/10/10 (1)	0.5	-	X
03/10/10 (1)	0.7	-	X
03/10/10 (1)	1	-	-
03/10/10 (1)	2	-	-
03/10/10 (1)	3	-	-
03/10/10 (1)	5	-	-

3.4 Baseline Air Particulates

Baseline (background) particulate levels were determined before ultrasonic scaling procedures. Variation in the baseline particle counts for each particle size per day can be seen in Figure 15. The greatest variation between days was observed in the 0.3µm particle size, ranging from 820-3100ppm. The baseline from 2/11/2010 displayed the highest particle count for all sizes, but especially 0.3µm. The

flow rate of the air monitor was 1.9 LPM during this session compared to 3.0 LPM the other sessions. The particulate counts for this session appear to be greater than all other sessions. Initially, it was considered that this session would be an outlier and would have to be discarded. However, statistical analysis with and without this session included revealed that the variation seen during this session did not have a significant effect on the overall data.

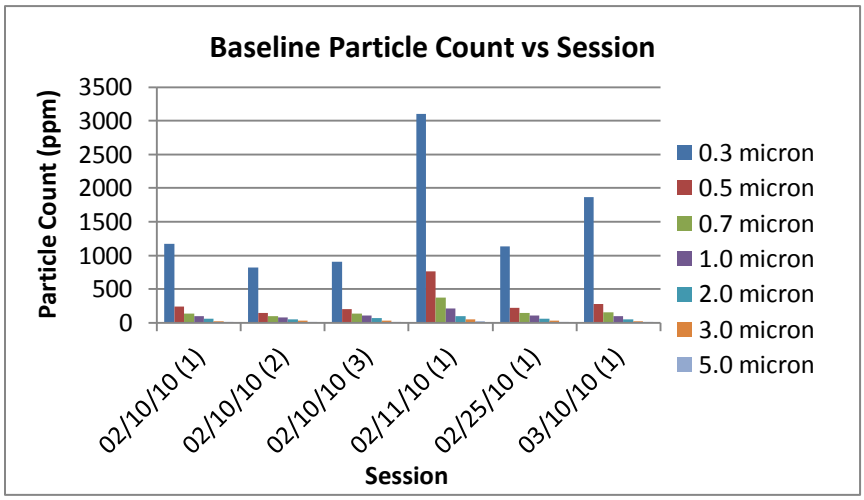

Figure 15 – Baseline Particle Count Prior to Ultrasonic Scaling versus Session

3.5 Travel Time

The average time from the start of ultrasonic scaling to the initial rise in particle counts was calculated. This distance was consistently set at 26" from the aisle and 8" from the edge of the counter during each session at the dental clinic. The average travel time for particles was calculated in minutes (3.5± 3.0) (Table 11 and Figure 16).

Table 11 – Time from Start of Ultrasonic Scaling to Particle Count Increase

Size (µm)	02/10/10 (1)	02/10/10 (2)	02/10/10 (3)	02/11/10 (1)	02/25/10 (1)	03/10/10 (1)	AVG	STDEV
0.3	2	0	2	7	6	4	3.50	2.97
0.5	2	0	2	7	6	4	3.50	2.97
0.7	2	0	2	7	6	4	3.50	2.97
1	2	0	2	7	6	4	3.50	2.97
2	2	0	2	7	6	4	3.50	2.97
3	2	0	2	7	6	4	3.50	2.97
5	2	0	2	7	6	4	3.50	2.97

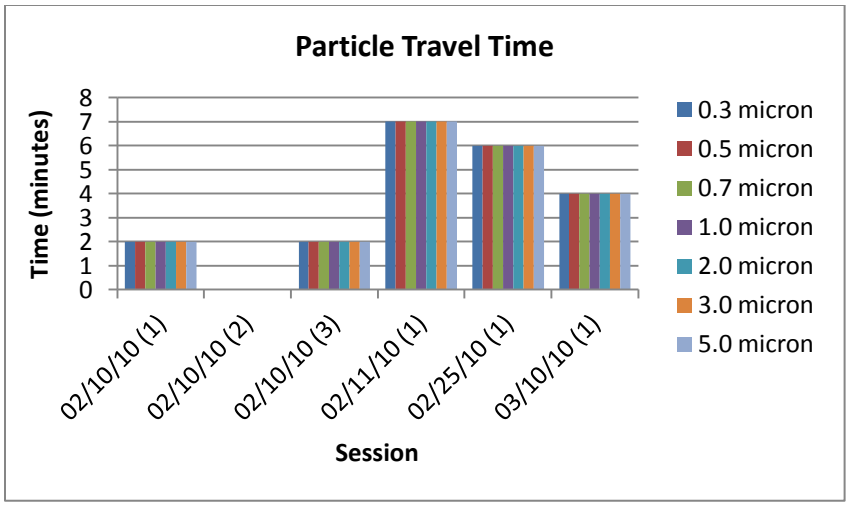

Figure 16 - Travel Time for Particles from Start of Ultrasonic Scaling to Peak

3.6 Additional Particulate Producing Clinic Procedures

Two events that caused spikes in particulate counts and therefore somewhat hindered analysis of the clinic data were sink use for hand washing and disinfectant spray downs at the completion of procedures. It is easy to understand why these procedures would generate a large and nearly immediate spike in particulate counts in all particulate sizes. For the sink use, large amounts of aerosolized water are being released mere inches from the air monitor, and with the spray down, excessive amounts of aerosolized disinfectant are being sprayed often directly beside or even towards the air monitor. The individual percent increases in particulate count and the average percent increase for each particulate size were determined for sink use (Figure 17 and 18). Figure 17 displays the variation of percent increases during different sink uses. Surprisingly, in one instance, the amount of particles 5µm in size is actually reduced (percent increase less than zero) while, in another instance, the amount of particles 0.7µm in size is increased by 3,096%! The average percent increases during sink use for each individual particle size were 0.3µm (238 ± 285%), 0.5µm (555 ± 748%), 0.7µm (569 ± 909%), 1.0µm (462 ±760%), 2.0µm (304 ± 527%), 3.0µm (152 ± 219%), and 5.0µm (110 ± 271%).

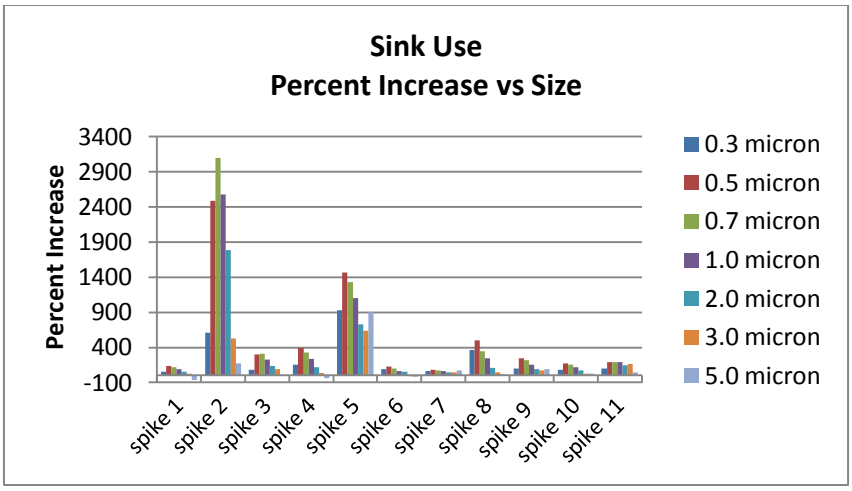

Figure 17 - Sink Use Percent Increase versus Size

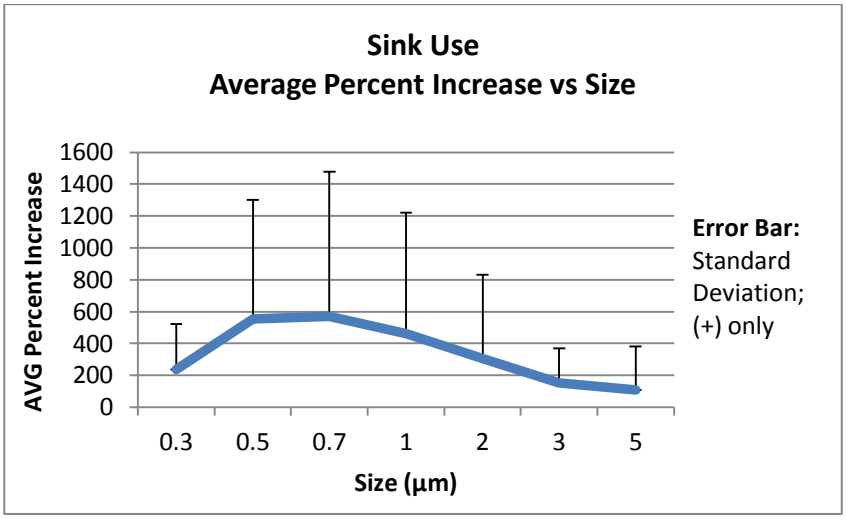

Figure 18 – Sink Use Average Percent Increase versus Size

The individual percent increases in particulate count and the average percent increase for each particulate size were determined for disinfectant spray downs (Figures 19 and 20). The particle count percent increase ranged from 39% for 5.0µm to 3334% for 0.5µm (Figure 20). The average percent increases during spray downs for each individual particle size were 0.3µm (394 ± 645%), 0.5µm (841 ± 1395%), 0.7µm (838 ± 1351%), 1.0µm (787 ± 1248%), 2.0µm (599 ± 902%), 3.0µm (427 ± 592%), and 5.0µm (372 ± 498%).

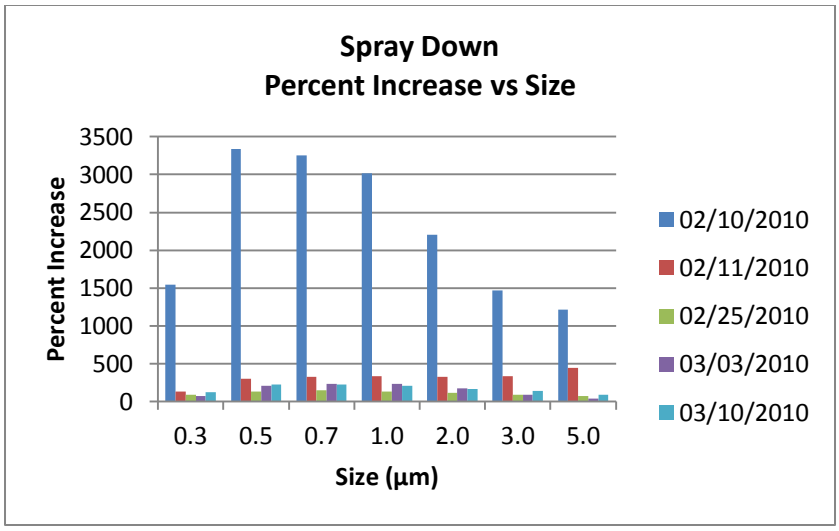

Figure 19 – Disinfectant Spray Down Percent Increase versus Size

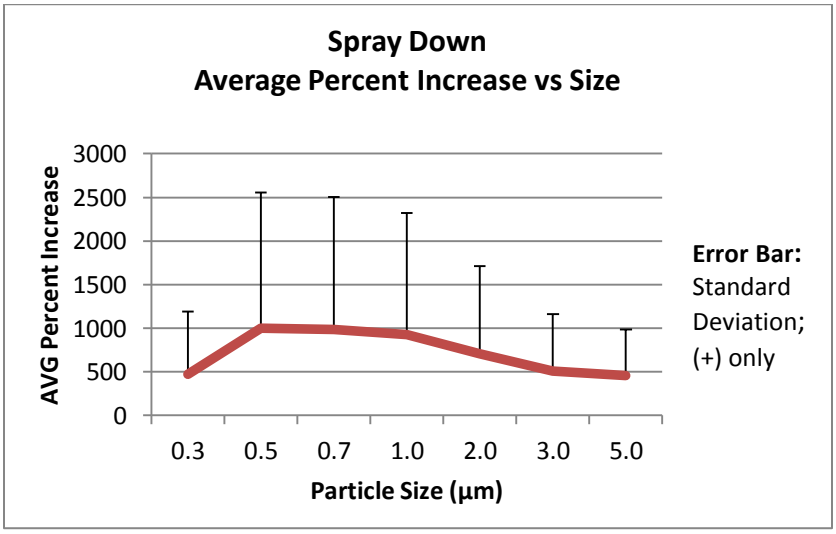

Figure 20–Disinfectant Spray Down Average Percent Increase versus Size

Averages of the percent increases show which size particles are being produced during the sink use and disinfectant spray downs, and in both cases 0.5µm and 0.7µm show the largest increase, with 0.7µm leading during the sink use and 0.5µm leading during the spray down (Figures 18 and 20). Due to the large percent increases of these size particles (0.5µm and 0.7µm), it is likely these procedures may have had an effect on the ultrasonic scaling data.

3.7 Background Influences

In some sessions, the baseline or background particulate level appears to fluctuate across all sizes. In order to rule out any possible background influences other than the sink use and the disinfectant spray downs that may have had an effect on the particulate count, two additional variables were evaluated. Relative humidity and temperature were consistently measured each day of data collection. The analyses of relative humidity and temperature on background air particulate levels are explained below. Other variables such as air currents due to the air conditioning cycles, possible influence of opening doors, foot traffic in the aisles, position of the dental hygienist relative to the patient during procedures, etc., very likely had an effect on the particulate matter measurement. However, the scope of this project did not allow for analysis of these variables.

3.8 Relative Humidity and Temperature

Relative humidity was analyzed to determine if it played a role in total particulate levels. The relative humidity in the clinic ranged from 23 - 62%. It appears that lower relative humidity results in a larger amount of suspended particles. Aerosols in dry air (low humidity) are more likely to evaporate, form droplet nuclei and remain suspended (23). The implications of this for the dental setting could result in higher rates of disease transmission. Figure 21 displays the relationship between particulate level and humidity specifically for 0.5µm but is representative of the relationship for all particle sizes analyzed.

In a similar way, temperature was analyzed to determine if it played a role in total particulate levels. The temperature in the clinic ranged between 16.4- 29.6 °C. It appears that the particulate levels are lower with lower temperatures. This could imply that there is a threshold energy level needed for particles to travel. Because changes in humidity are largely dictated by changes in temperature, any temperature differences created by movement, door openings, and air conditioning cycles may impact particle movement (16, 23) and, therefore, disease transmission. Figure 22 displays the relationship

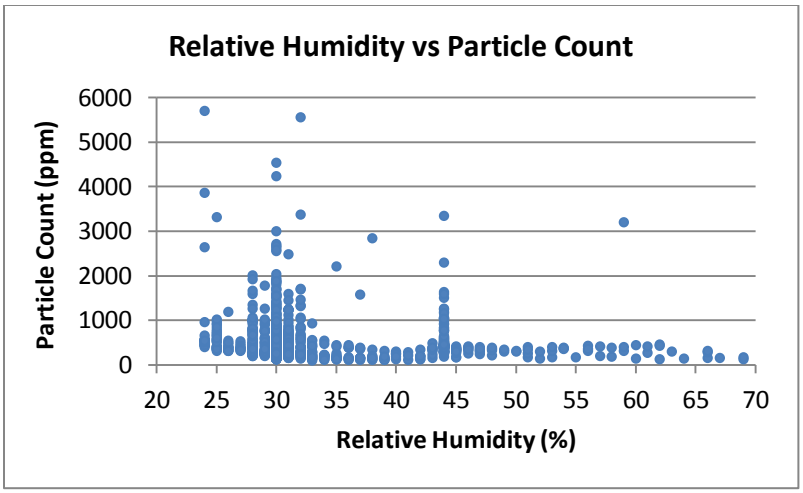

Figure 21 – Clinic Relative Humidity versus Particle Count

between particulate level and temperature specifically for 0.5µm and is representative of all particulate sizes analyzed. This data was provided and recorded each minute by the air monitor.

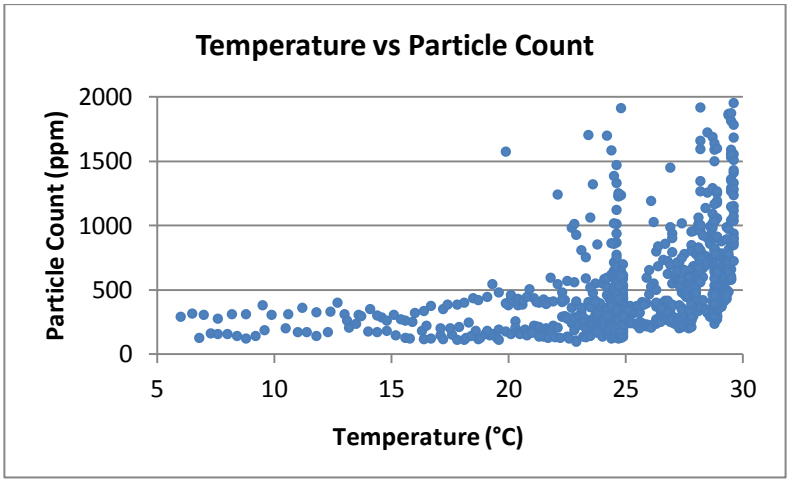

Figure 22 – Clinic Temperature versus Particle Count

3.9 Survey

Two separate statistical analyses were conducted on the survey data. The first statistical test analyzed the effect of a limited number of questions answered by all students (DH1 and DH2). The second test analyzed the effects of all the questions answered by only the DH2 students.

In the first analysis (DH1 and DH2), a regression using backward elimination within PROC LOGISTIC showed the only variable to have a significant effect on the likelihood of experiencing

flu-like symptoms/upper respiratory symptoms was Flu08 (p=0.0009) (Table 12). The Odds Ratio for having experienced flu-like symptoms and having answered "no" to a flu shot in 2008 compared to having answered "yes" is 0.169:1 (Table 12). This means the students who did receive a flu shot in 2008 were ~5 times more likely to experience respiratory symptoms compared to those who did not receive a flu shot. The second analysis (DH2 only) revealed no significant effects from any of the variables (p>0.05) (Table 13).

Table 12 – Significant Effects of All Variables in the First Analysis of the Survey; significant effect found of Flu08 and Odds Ratio for Flu08 from the PROC LOGISTIC Analysis

First Analysis - DH1 and DH2 Summary of Backward Elimination						
Step	Effect Removed	DF	Number In	Wald Chi-Square	Pr > ChiSq	Variable Label
1	Smoke	1	8	0.0593	0.8077	Smoke
2	Race	2	7	0.2073	0.9015	Race
3	HOR	1	6	0.0226	0.8806	HOR
4	Sex	1	5	0.0040	0.9498	Sex
5	Group	3	4	2.0287	0.5665	Group
6	Flu09	1	3	0.2004	0.6544	Flu09
7	ClinWk	3	2	6.5330	0.0884	ClinWk
8	Age	1	1	1.7430	0.1868	Age

First Analysis - DH1 and DH2 Type 3 Analysis of Effects			
Effect	DF	Wald Chi-Square	Pr > ChiSq
Flu08	1	11.0570	0.0009

First Analysis - DH1 and DH2 Odds Ratio Estimates			
Effect	Point Estimate	95% Wald Confidence Limits	
Flu08 N vs Y	0.169	0.059	0.482

Table 13 – Significant Effects of All Variables in the Second Analysis of the Survey

Second Analysis – DH2 Only Summary of Backward Elimination						
Step	Effect Removed	DF	Number In	Wald Chi-Square	Pr > ChiSq	Variable Label
1	PScale	1	11	0.0022	0.9627	PScale
2	Mask	1	10	0.0016	0.9685	Mask
3	Flu09	1	9	0.0006	0.9813	Flu09
4	Smoke	1	8	0.0033	0.9541	Smoke
5	HOR	1	7	0.0012	0.9726	HOR
6	ClinHr	6	6	1.4613	0.9620	ClinHr
7	Group	1	5	0.0177	0.8942	Group
8	Race	1	4	0.1121	0.7378	Race
9	ClinWk	2	3	0.9174	0.6321	ClinWk
10	H1	1	2	1.7478	0.1862	
11	Age	1	1	2.4323	0.1189	Age
12	Flu08	1	0	3.0736	0.0796	Flu08

After determining the variable Flu08 as significant, the Chi-Square Test of Independence within PROC FREQ tested the null hypothesis that the proportion of students who received the flu shot in 2008 and did experience flu-like symptoms is the same as the proportion of students who did not receive the flu shot in 2008 and did experience flu-like symptoms. Since the significance level for this test was p=0.0004, the null hypothesis is rejected, and the conclusion is that the proportions are not the same (Table 14). This result reinforces the significant effect that Flu08 had on the likelihood of experiencing flu-like symptoms.

Table 14 – Chi-Square Test of Independence from the PROC FREQ Analysis

Statistic	DF	Value	Prob
Chi-Square	1	12.3553	0.0004
Likelihood Ratio Chi-Square	1	12.7213	0.0004
Continuity Adj. Chi-Square	1	10.7549	0.0010
Mantel-Haenszel Chi-Square	1	12.2195	0.0005

CHAPTER 4: DISCUSSION, RECOMMENDATIONS AND FUTURE RESEARCH

4.1 Discussion

Previous research demonstrates increased incidence of respiratory infections amongst dental hygienists compared to the general population and even their medical colleagues (14). Dental personnel also display higher (than normal) rates of Legionella antibody titres, in direct correlation to their clinical work time. This indicates exposure to these microbes in some way (14). Dental personnel are also at much greater risk of infection by Hepatitis B and C (21). Since the general public does not display these trends, one may infer that dental hygienists' profession is the likely source.

National regulatory agencies indicate the need to monitor particulate matter and infectious aerosol levels - especially in confined areas, such as a dental office - as they are known to contribute to respiratory irritation/infection and spread disease. While general infection control measures are encouraged in all dental practice, indoor air quality standards do not exist at this time. The only water quality standard for DUWL is the same as for potable water (<200 CFU/ml). This leaves the burden on the dental personnel to establish and uphold their own safety protocols in their working environment.

There are countless infectious agents known to spread via contaminated aerosols. The nature of dental procedures and their location inside the oral cavity make them ideal sources for potentially pathogenic aerosols. Ultrasonic scaling has been reported to produce the greatest amount of contaminated aerosols compared to all other dental procedures.

The goal of the present study was to determine if dental hygienists were at an increased risk of developing upper respiratory infections and to determine if certain procedures (ultrasonic scaling) contributed to that risk. In pursuit of that goal, the present study quantitatively measured particulate/aerosol levels during dental procedures utilizing an air monitor instrument. Specific emphasis was given to aerosols produced during ultrasonic scaling.

When all sessions were reviewed, the current study found a statistically significant increase in particle counts during the Initial Cavitron period over the Baseline particle counts ($p=0.0002$). A statistically significant increase in particle counts during the Total Cavitron period over the Baseline particle counts was also found ($p=0.0063$). A difference was found between the Initial Cavitron and Total Cavitron particle counts, but this difference was not statistically significant ($p=0.2922$). When compared within sessions, statistically significant differences were also found between the Initial Cavitron and Baseline particulate counts ($p<0.05$) as well as between the Total Cavitron and Baseline particulate counts ($p<0.05$) for specific particle sizes (Table 10).

In the present study, no causal relationship can be determined between the increased levels of particulates found during ultrasonic scaling and the increased incidence of respiratory infections found amongst dental personnel. This study demonstrated increased levels of particulates/aerosols in particle sizes significant to microorganisms (viruses, bacteria, fungi) during dental hygiene procedures. Recognizing that the dose makes the poison, one would reasonably conclude that an increased exposure level increases the risk of developing an upper respiratory infection. Therefore, if infectious and/or pathogenic agents are present in the aerosols shown in this study to be produced during ultrasonic scaling, dental hygienists, by the nature of their profession, in close proximity to the produced aerosols, are at a greater risk of infection by simple means of increased exposure.

Beyond statistical testing, the percent increase in particulate counts was calculated (Table 4 and 5). The results of this project suggest the composition of the particulates in the air is changing during ultrasonic scaling and the particulate sizes increasing the most proportionally are 0.5, 0.7 and 1.0 micron in diameter. These sizes are relevant to potential disease transmission. This potential exists because these particulates are large enough to carry infectious microbes (bacteria, viruses) but also small enough to penetrate the respiratory tract to the alveoli level. These infectious agents can be easily inhaled without the dental hygienist's knowledge. While 0.5, 0.7 and 1.0 micron size particles displayed the

greatest percent increase in particle counts during ultrasonic scaling, this does not imply these sizes had the greatest particle counts. Despite the time or dental procedure taking place, 0.3 micron particles always had the largest particle count. The particle count for 0.3 micron diameter particles remained high relative to all other particles even on days when the clinic was closed to all dental personnel. However, while having the greatest number of particles, 0.3 micron diameter particles also had the least variability of any size particle. The 10.0 micron diameter particle size showed little variability throughout all procedures, i.e. zero particle counts for the majority of all procedures. This low variability leads to few conclusions. Taking these factors into consideration, the present study mainly focused on particle sizes ranging from 0.5 – 5.0 micron in diameter.

The huge percent increases in particle counts for particle sizes 0.5 and 0.7 micron observed in this project during sink use and disinfectant spray downs may have affected the analysis of ultrasonic scaling procedures. The production of these particulate sizes is important to disease transmission in the same way as describe previously for ultrasonic scaling. There is added danger during disinfectant spray downs because dental hygienists have usually removed their personal barrier protection leaving them directly exposed to any contaminated aerosols suspended in the air.

There were additional factors that undoubtedly influenced the particle count. These included: air conditioning cycles, foot traffic and movement by dental hygiene students and instructors, patient movement, and the researcher's presence beside the cubicle. The scope of this project did not allow for the isolation or analysis of the possible impact of these outside variables on the particle count.

A survey was completed by 1st and 2nd year dental hygiene students on two separate occasions. These surveys included basic and dental hygiene specific questions aimed to determine the effect, if any, on the incidence of respiratory symptoms. Statistical analysis determined the only variable to have a significant effect on the likelihood of experiencing flu-like symptoms was if a flu shot was received in

2008 (p=0.0009). The Odds Ratio demonstrated students who received a flu shot in 2008 were ~5 times more likely to experience respiratory symptoms compared to those who did not get a flu shot.

4.2 Recommendations

While dental hygienists utilize personal barrier protection – goggles, face masks, gloves, disposable gowns, etc. – to minimize exposure levels to the aerosols produced during dental procedures, more could be done to help reduce their exposure level. The realistic practice of dental hygiene often presents instances where the main shield – the face mask – is removed completely, in order to effectively converse with the patient.

Beyond standard barrier methods, there are a few practices consistently recommended to further reduce the risk posed by aerosols produced during dental procedures. These include: pre-procedural rinses, dental dams, and high volume evacuators (HVE) (5, 6, 20). The pre-procedural rinse helps to kill any live microbes on the surface within the oral cavity thereby reducing the initial amount of potentially pathogenic microbes available to become aerosolized during procedures. However, the rinse does not kill any microbes within the biofilm (plaque), subgingival level, blood or nasopharynx. The dental dam isolates the tooth and confines blood and saliva reducing the liquid and microbes available to become aerosolized. Dental dams do not have as much applicability to dental hygiene practices compared to other dental procedures, e.g. root canals. However, their use during procedures when dental hygienists serve as assistants to dentists may reduce the dental hygienist's overall risk of exposure.

High volume evacuators (HVE) are used in dentistry to remove high volumes of aerosols (up to 100 cubic feet of air per minute) from the oral cavity area as they are being produced during ultrasonic scaling (6). If used correctly, HVEs are capable of removing >90% of all aerosols produced during these procedures. The limitation of the HVE is that it typically requires an assistant or attachment to be utilized.

While the patient is understood to be the greatest source of potentially pathogenic microbes to the dental hygienist, proper maintenance of the microbial population in DUWL is equally essential in reducing the risk posed to the dental hygienist. Regardless of the source of the water (main or reservoir), DUWL should be routinely checked and, if necessary, disinfected. All instruments should be sterilized, disinfected or discarded properly.

The establishment of Indoor Air Quality Standards is absolutely vital to reduce the risk of infection and ensure a future safe environment for dental personnel. This endeavor could perhaps best be achieved through a collaborative effort with the Environmental Protection Agency (EPA), Department of Environmental Quality (DEQ) and American Dental Association (ADA).

4.3 Future Research

In order to more accurately pinpoint the exact effect of ultrasonic scaling on aerosol production alone, one option for future research could possibly incorporate a type of isolation chamber. During ultrasonic scaling only the patient's head/upper body and the dental hygienist's hands would be located in the chamber. Micik *et al* (12) used just such an experimental design for their early aerobiology work. The use of a similar model for the present work would eliminate the effects of foot traffic and movement, air conditioner cycles, sink use and the researcher's presence while utilizing the more advanced technology of new air monitors available.

Another option for future research could be the use of an air monitor capable of distinguishing between particulate and aerosols. While much focus is given to the aerosols produced by ultrasonic scalers, they also produce particulates from solids such as tooth debris, calculus, etc. The ability to distinguish between the percent of solid particles (particulates) and liquid (aerosol) would provide a more accurate picture of what is produced during ultrasonic scaling. This distinction may better reveal the effect of other events such as foot traffic/movement and sink use on overall particle counts.

An additional option for further research could be a longitudinal study. Current dental hygiene students along with dental hygiene graduates (3-5 years post) could be surveyed to determine if some resistance to microorganisms has been established from chronic low-grade exposure. It has been reported that dental personnel have an increased incidence of respiratory infections compared to the general public or other medical workers (14). Contrary to the theory of acquired resistance, dental hygienist may be more at risk of infection after years of practice compared to students. An added facet would be to survey dental hygienists in both public and private settings.

A final suggestion for future research would be the testing of the dental unit waterlines in the Dental Hygiene Clinic at the LSU School of Dentistry at various times and locations. Samples could be collected in the morning at the beginning of the week prior to flushing, post flushing, post first patient, post lunch break, and post final patient. This schedule could be duplicated later in the week to pinpoint variation between days. Microbial testing could be conducted on these samples from the DUWL and other surfaces, i.e. sink, cavitron, air-water turbine, mask, and goggles. Samples should be tested for anaerobic bacteria specifically because it is the causative agent in most periodontal disease. Counts of aerobic bacteria, viruses, fungi, prions, protozoa, and specifically *Legionella* spp., *Mycobacteria* spp., *Pseudomonas* spp., hepatitis B and C, HIV, HPV, *Herpes simplex* and Tuberculosis should also be of interest.

CHAPTER 5: CONCLUSION

Microorganisms carried by aerosols produced during dental procedures present a potential risk of infection to both dental personnel and patients. All possible precautions should be taken to prevent the spread of infection within the dental setting. Knowledge yields power. Only with a thorough understanding of the bioaerosols produced during dental procedures can dental personnel make fully informed decisions regarding the protective measures during their clinical practices. This study sought to add one more piece to the puzzle to complete the picture.

The current study determined ultrasonic scaling procedures significantly increase the amount of aerosols in sizes significant to infection transmission (<2 micron). Dental personnel experience an increased incidence of respiratory infections. Their increased exposure to aerosol levels produced during ultrasonic scaling procedures may be the cause. Incorporation of protective measures beyond simple barrier methods and the establishment of Indoor Air Quality Standards could reduce dental hygienist's overall risk of developing respiratory infections. There are many possible options for future research in this field, as noted previously in the Discussion. Any option suggested would, like the current study, add an additional piece to the puzzle of understanding possible causes for the increased incidence of respiratory infections in dental personnel. For the protection of dental hygienists and reduction in the spread of disease, future efforts should aim to minimize risk as much as possible.

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APPENDIX A: INSTITUTIONAL REVIEW BOARD (IRB) FORM

LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER IN NEW ORLEANS
INSTITUTIONAL REVIEW BOARD (IRB)
APPLICATION FORM

+++INSTRUCTIONS ***

COMPLETE THIS APPLICATION AND SUBMIT THE FOLLOWING TO THE IRB OFFICE, RESOURCE CENTER, Rm 206,433 BOLIVAR ST., NEW ORLEANS, LA 70112: AN ORIGINAL AND ONE COPY OF THE APPLICATION FORM, TWO COPIES EACH OF AN EXPANDED PROTOCOL OR GRANT APPLICATION DESCRIBING THE RESEARCH PROJECT AND THE CONSENT FORM. DO NOT SUBMIT DOCUMENTS PRINTED ON BOTH SIDES, WITH THE EXCEPTION OF THE FULL PROTOCOL. COMPLETE ALL SECTIONS OF THE IRB FORM. IF ANY SECTION IS NOT APPLICABLE TO YOUR PROJECT MARK (N/A). IRB MEETINGS ARE HELD ON THE THIRD (3RD) WEDNESDAY OF EVERY MONTH. THE DEADLINE FOR RECEIPT OF APPLICATIONS IN THE IRB OFFICE IS THE LAST WORKING WEDNESDAY OF THE MONTH PRIOR TO THE NEXT MONTH'S MEETING WITH NO EXCEPTIONS! ONLY TYPED APPLICATIONS WILL BE ACCEPTED. IF YOU HAVE QUESTIONS CALL 568-4060.

1. Project Title (If applicable include IND or IDE number)
Bioaerosol Exposures and Outcomes in Dental Hygienists

2a. LSUHSC Investigator's Name (Faculty Mentor's Name If Applicable)	2b. Degree	2c. Social Security No.:
Dr. James Diaz	M.D. Dr.P.H.	
3a. Non-faculty Name (Student, fellow, etc.)	**3b. Degree**	**3c. Social Security No.:**
Chase Villeret	B.S. -M.P.H. Candidate	
Anna L. Wanko	B.S. -M.P.H. Candidate	

4. School	5. Department
School of Public Health	ENHS
6. Room and Building	**7. Phone(s) FAX and Email**
Suite 1500 1615 Poydras	504-884-1748 cvill1@lsuhsc.edu

8. Performance Site(s) [eg. Medical Center of Louisiana, LSU Clinics, etc.]
LSUHSC School of Dentistry, Dental Hygiene Department

9. Subject Category(s):

X	Healthy Adult	____	Emotionally Impaired
____	Physically Impaired	____	Minors
____	Others Incapable of Giving Informed Consent	____	Other

10. If you feel your study should be either exemptd or expedited, please designate the appropriate categories as described on page 4 of the application packet.

Exempt _____ 45CFR46.101b, 21CFR56.104 or Expedited X 45CFR46.110, 21CFR56.110

11. INVESTIGATOR ASSURANCE: I agree to obtain informed consent of subjects who are to participate in this project; to report to the IRB any unanticipated adverse effects on subjects which become apparent as a result of the study and any corrective action taken; to obtain prior approval from the IRB before amending or altering the project as approved by the IRB, or implementing changes in the approved consent form; to maintain documentation of consent forms and progress reports as required by institutional policy and to follow guidelines of the IRB regarding child assent.

_____ Signature of Principal Investigator

_____ Date

12a. Co-Investigator(s)	12b. Degree(s)	12c. Phone(s)	12d. Signature(s)
Chase Villeret	B.S.	504-884-1748	_
Anna L. Wanko	B.S.	985-630-7387	_

By signing this form, I certify that the investigator has permission to conduct the study if approved, has the expertise to conduct the study and is an employee in good standing.

Revised Jan 2000

LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER IN NEW ORLEANS
INSTITUTIONAL REVIEW BOARD (IRB)
APPLICATION FORM

13a. Department Head James Diaz, M.D. Dr.P.H.	13b. Department Head's Signature

14. Project Summary: Explanation in nonmedical terminology including rationale for the study, procedures, previous experience with treatment or test, risks to subjects, safeguards, alternatives, etc.

NOTE: A Guide to preparing the project summary is available in the instruction section of the application packet. For further information call the IRB Office 568-4060

The study at hand is a survey exposure case control study given to the LSUHSC School of Dentistry Dental Hygiene Students to evaluate the association between occupational bioaerosol exposure in dental hygienists and the risk of contracting repeated Upper Respiratory Tract Infections. In this study, data will be collected through voluntary surveying of the dental hygiene students at the LSUHSC School of Dentistry. The co-investigators of this study, Chase Villeret and Anna Wanko, met with Ms. Caroline Mason, Director of Dental Hygiene at the LSUHSC School of Dentistry and decided that the best time to survey is the last week of March or the beginning of April. The researchers of this study plan to go to the school during school hours during this time period to survey the dental hygiene students. First, The researchers will ask the instructors of the course to briefly leave the room, and then they will give a verbal and written explanation of the study to the students. Those who volunteer will then be given a simple survey which will ascertain the hygiene students' exposure to bioaerosols and their occurrence of flu like symptoms during the fall 2008 semester. Those who do not wish to participate in the study will be asked to leave the entire form blank as an alternative to participation, and will not be identified in any way. Therefore, no repercussions will be involved with non-participating students. The survey forms to be filled out will in no way require the use of the names of the participants in the study. Hence, this is strictly an anonymous survey. If any question(s) in the survey makes the participant feel uncomfortable, they can chose not to answer that question(s). Once the voluntary surveys are filled out, the researchers, Anna L. Wanko, Chase T. Villeret, and James Diaz, M.D., Dr.P.H, will take the forms and analyze the data given in order to be presented in an oral presentation in front of the LSUSHC School of Public Health. The researchers previously mentioned will be the only individuals with access to the surveys and the information listed on them. A written article may potentially be formed afterwards for publication based on that data and analysis given in the oral presentation previously mentioned.

In this study there is no treatment to be given, no prolonged period of study, and no risk of endangerment to study participants by any means. This is an anonymous survey, and the participants will not be required to put their names or any other form of identification on their forms other than general information such as age, sex, race, and class year (DH1 or DH2). The information given in this study will be used for the study purposes previously mentioned and those purposes only. Questions about prior medical history related to respiratory infections are asked on the survey, however, a review of certified or uncertified medical records will not be a part of the research protocol. Therefore, in addition to the submission of this application, the researchers of this study are also submitting a HIPAA De-identification form because this study will not collect any Protective Health Information (PHI) and requesting a waiver of documentation of informed consent. The researchers of the study will give the potential participants a verbal and written explanation of the study. The study description, procedures, and risks previously mentioned above are in accordance with federal regulations 45 CFR 46.117.c which allows for a waiver of documentation of informed consent if the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.

APPENDIX B: DENTAL HYGIENE SURVEY

Bioaerosol Exposures and Outcomes in Dental Hygienists

PLEASE READ:

The study at hand is a survey exposure case control study given you, the LSUHSC School of Dentistry Dental Hygiene Students to evaluate the association between occupational bio-aerosol exposure in a dental hygiene setting and risk of contracting repeated Upper Respiratory Tract Infections. In this study, we will collect voluntary data from you through a simple survey. We have asked the instructor(s) of the course to leave the room so no one here feels coerced into taking this voluntary study. If you volunteer, then you will be given a simple survey which will ascertain dental hygiene related' exposure to bio-aerosols and the occurrence of flu like symptoms during the fall 2008 semester. If you do not wish to participate in the study, then you will be asked to leave the entire form blank as an alternative to participation, and will not be identified in any way. Therefore, no repercussions will be involved with non-participation. The survey forms to be filled out will in no way require the use of your name. Hence, this is strictly an anonymous survey. If any question(s) in the survey makes you feel uncomfortable, you can chose not to answer that question(s). Once the voluntary surveys are filled out, the researchers, Christen Gautreau, Anna L. Wanko, Chase T. Villeret, and James Diaz, M.D., Dr.P.H, will take the forms and analyze the data given in order to be presented in an oral presentation in front of the LSUSHC School of Public Health. The researchers previously mentioned will be the only individuals with access to the surveys and the information listed on them. A written article may potentially be formed afterwards for publication based on that data and analysis given in the oral presentation previously mentioned.

In this study there is no treatment to be given, no prolonged period of study, and no risk of endangerment to you by any means. As previously mentioned, this is an anonymous survey, and you are not be required to put your name or any other form of personal identification on this form(s). The information given in this study will be used for the study purposes previously mentioned and those purposes only.

Thank You,

James Diaz, M.D., Dr.P.H.
LSUHSC School of Public Health- Dept. Head and Faculty ENHS
Principal Investigator

Chase Villeret, B.S.
LSUHSC School of Public Health- M.P.H. Candidate
Co- Investigator

Anna L. Wanko, R.D.H. B.S.
LSUHSC School of Public Health- M.P.H. Candidate
Co- Investigator

Christen Gautreau, B.S.
LSUHSC School of Public Health-M.P.H. Candidate
Co-Investigator

Directions: Please circle or fill in the answer to all of the following questions below to **the best of your knowledge**. Please write legibly when necessary. If any question(s) in the survey makes you feel uncomfortable, you can chose not to answer that question(s).

1. DH1 or DH2? 1a. How many clinics do you attend per week? ____

2. Age: (Circle one) **18-25 or 26 or older** 3. Sex: (Circle one) **M or F**

4. What is your race or ethnicity? A) Caucasian B) African American
C) Hispanic/Latin American D) Asian American E) Other: Please Specify

5. Did you smoke 100 cigarettes (5 packs) or more during the prior Semester? (Circle One)
Yes or No

6. Did you receive a flu shot during or before the fall of 2008? **Yes or No** 2009? **Yes or No**

7.During the fall semester, did you experience a combination of 3 or more of the following symptoms for a day or more; chills, fever, sore throat, muscle pains, severe headache, coughing, weakness, or general discomfort? (Circle one) **Yes or No**

8. **DH2 only:** a. How many hours per week do you spend in the clinic? _____hours.

b.How often did you <u>only handscale</u> on patients?
(Please Circle One Answer. 1= Always 5= Never) **1 2 3 4 5**

9. **DH2 only:** Did you use any type of power scaler on patients?
(Please Circle One Answer. If no, skip to question 10) **Yes or No**

a. Which of the following power scalers would you say you use the most?
(Circle One Answer) **piezo or cavitron**

b. Did you use a high evacuation suction tip during the process of power scaling?
(Circle One Answer) **Yes or No**

c. Did you use a low evacuation suction tip during the process of power scaling?
(Circle One Answer) **Yes or No**

10. **DH2 only:** Which of the following best describes how often you change your mask in the clinic?
(Circle One Answer) **A. by the hour B. by the patient C. by the day**

11. Do you have a history of any permanent respiratory condition (eg. Asthma, severe allergies, Chronic Bronchitis, etc…if yes, please specify) **Yes No**

_____
_____

12. Do you have a history of immunologic suppression? (eg. Blood disorder, HIV/AIDS …if yes, please specify) **Yes No**

_____
_____

APPENDIX C: AIR MONITOR RAW DATA

Time and Date	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/10/2010 8:58	986	125	64	42	21	11	4	1	0	3	6.8	69
2/10/2010 8:59	973	162	98	64	40	15	7	0	0	3	7.3	69
2/10/2010 9:00	877	157	99	70	39	22	7	4	0	3	7.6	67
2/10/2010 9:01	915	156	96	72	39	19	5	1	0	3	8	66
2/10/2010 9:02	892	142	81	59	32	20	5	0	0	3	8.4	64
2/10/2010 9:03	820	123	75	45	23	9	6	0	0	3	8.8	62
2/10/2010 9:04	887	140	90	65	41	17	8	4	0	3	9.2	60
2/10/2010 9:05	939	186	115	80	43	21	7	1	0	3	9.6	58
2/10/2010 9:06	7486	3195	1683	898	295	74	20	0	0	3	10.1	59
2/10/2010 9:07	907	200	122	86	48	31	10	5	0	3	10.5	57
2/10/2010 9:08	887	172	105	74	41	16	7	0	0	3	11	55
2/10/2010 9:09	856	173	101	69	44	25	10	2	0	3	11.4	53
2/10/2010 9:10	833	142	88	62	29	12	7	2	0	3	11.8	52
2/10/2010 9:11	903	171	109	77	46	22	9	0	0	3	12.3	51
2/10/2010 9:12	1371	400	233	145	70	28	3	1	0	3	12.7	51
2/10/2010 9:13	990	208	114	71	25	7	1	1	0	3	13.2	48
2/10/2010 9:14	979	236	158	110	59	26	8	2	0	3	13.5	47
2/10/2010 9:15	884	175	111	86	49	31	12	2	0	3	14	45
2/10/2010 9:16	844	170	95	68	42	20	10	2	0	3	14.4	45
2/10/2010 9:17	889	181	115	81	47	23	7	1	0	3	14.8	44
2/10/2010 9:18	877	148	84	60	30	13	5	1	0	3	15.2	43
2/10/2010 9:19	858	128	75	56	32	14	2	0	0	3	15.6	42
2/10/2010 9:20	892	123	65	46	26	13	3	0	0	3	15.8	42
2/10/2010 9:21	944	181	95	67	37	19	8	0	0	3	16.3	42
2/10/2010 9:22	909	115	78	58	34	13	6	2	0	3	16.4	41
2/10/2010 9:23	877	123	62	49	30	16	3	0	0	3	16.7	40

2/10/2010 9:24	893	146	89	59	37	18	7	2	0	3	17.1	39
2/10/2010 9:25	819	117	55	40	22	11	5	1	0	3	17.2	39
2/10/2010 9:26	900	149	79	45	18	8	2	0	0	3	17.6	39
2/10/2010 9:27	766	109	48	31	18	9	3	0	0	3	17.8	39
2/10/2010 9:28	831	111	63	41	22	6	3	1	0	3	18.1	38
2/10/2010 9:29	847	128	67	45	25	16	3	2	0	3	18.2	38
2/10/2010 9:30	858	141	83	56	38	18	5	1	0	3	18.4	38
2/10/2010 9:31	828	118	56	41	20	8	2	0	0	3	18.7	37
2/10/2010 9:32	900	128	50	23	12	4	1	0	0	3	18.8	37
2/10/2010 9:33	948	158	80	55	31	11	8	1	0	3	19	37
2/10/2010 9:34	920	148	80	60	29	9	5	0	0	3	19.2	37
2/10/2010 9:35	965	156	71	47	31	16	4	0	0	3	19.3	36
2/10/2010 9:36	931	124	54	37	14	4	2	0	0	3	19.5	36
2/10/2010 9:37	890	110	46	30	13	7	4	1	0	3	19.6	36
2/10/2010 9:38	6294	2841	1470	804	245	44	11	1	0	3	19.8	38
2/10/2010 9:39	3880	1574	779	421	143	37	13	0	0	3	19.9	37
2/10/2010 9:40	1432	379	198	108	47	22	10	3	0	3	20	36
2/10/2010 9:41	1255	255	122	79	36	18	4	0	0	3	20.3	35
2/10/2010 9:42	1211	206	104	72	40	15	6	0	0	3	20.3	35
2/10/2010 9:43	1042	176	87	57	28	10	4	2	0	3	20.4	35
2/10/2010 9:44	1145	162	86	50	27	13	4	2	0	3	20.5	35
2/10/2010 9:45	1055	190	105	71	38	16	6	0	0	3	20.7	35
2/10/2010 9:46	1007	150	66	48	23	5	1	1	0	3	20.8	35
2/10/2010 9:47	1082	171	85	65	24	14	5	0	0	3	20.9	34
2/10/2010 9:48	5260	2207	1093	608	202	56	8	2	0	3	20.9	35
2/10/2010 9:49	1233	222	113	67	27	11	4	1	0	3	21.1	34
2/10/2010 9:50	1114	207	110	65	30	14	3	1	0	3	21.2	34
2/10/2010 9:51	1168	215	105	59	43	21	8	2	0	3	21.2	34
2/10/2010 9:52	1109	212	115	71	42	25	11	4	0	3	21.3	34
2/10/2010 9:53	1094	176	83	54	33	13	2	0	0	3	21.4	34

2/10/2010 9:54	1125	192	106	77	40	17	7	1	0	3	21.5	34
2/10/2010 9:55	1150	202	121	98	62	29	10	2	0	3	21.6	33
2/10/2010 9:56	1158	190	104	68	40	22	4	0	0	3	21.7	33
2/10/2010 9:58	1058	189	114	72	47	18	5	0	0	3	21.8	34
2/10/2010 9:58	1061	161	91	73	44	21	9	1	0	3	21.8	33
2/10/2010 10:00	1101	223	136	101	66	33	13	4	0	3	21.9	33
2/10/2010 10:00	1095	211	120	85	49	22	9	1	0	3	21.9	33
2/10/2010 10:01	1080	208	120	79	47	24	5	1	0	3	22.1	33
2/10/2010 10:03	1701	544	320	202	86	40	12	4	0	3	22.1	33
2/10/2010 10:04	1502	477	286	210	106	43	13	3	0	3	22.3	33
2/10/2010 10:05	1142	292	193	140	87	41	17	5	0	3	22.3	33
2/10/2010 10:06	1426	421	280	226	131	64	28	4	0	3	22.4	33
2/10/2010 10:07	1226	293	202	163	108	57	23	1	0	3	22.4	32
2/10/2010 10:08	1122	283	194	152	84	53	23	6	0	3	22.5	33
2/10/2010 10:09	1142	276	173	136	83	46	20	4	0	3	22.5	33
2/10/2010 10:10	1068	241	146	111	66	30	5	2	0	3	22.7	32
2/10/2010 10:11	1192	253	148	112	61	38	14	1	0	3	22.7	32
2/10/2010 10:12	1275	284	176	129	81	36	12	1	0	3	22.8	32
2/10/2010 10:13	1213	282	179	135	80	37	13	4	0	3	22.8	32
2/10/2010 10:14	1215	185	102	77	47	21	11	2	0	3	22.8	32
2/10/2010 10:15	1885	560	325	209	101	39	11	3	0	3	22.8	33
2/10/2010 10:16	2546	929	502	293	122	42	12	4	0	3	22.9	33
2/10/2010 10:17	1559	408	242	154	93	45	19	2	0	3	22.9	32
2/10/2010 10:18	1265	294	174	116	63	33	12	2	0	3	23	32
2/10/2010 10:19	1143	226	116	82	42	21	14	1	0	3	23	32
2/10/2010 10:20	1260	326	206	143	86	34	11	0	0	3	23.1	32
2/10/2010 10:21	1279	284	160	110	67	33	9	3	0	3	23.2	32
2/10/2010 10:22	1090	229	123	82	42	21	6	1	0	3	23.2	32
2/10/2010 10:23	1094	206	112	77	41	24	6	1	0	3	23.3	32
2/10/2010 10:24	1154	239	109	74	37	19	2	2	0	3	23.2	31

2/10/2010 10:25	1171	249	129	82	47	22	8	2	0	3	23.2	32
2/10/2010 10:26	1066	203	108	72	37	17	11	4	0	3	23.3	32
2/10/2010 10:27	1408	406	221	132	53	21	6	0	0	3	23.4	32
2/10/2010 10:28	4004	1704	953	558	202	62	14	3	0	3	23.4	32
2/10/2010 10:29	1226	266	144	90	39	15	4	0	0	3	23.5	32
2/10/2010 10:30	1160	219	92	60	29	14	5	0	0	3	23.5	31
2/10/2010 10:31	1184	249	145	97	54	19	7	1	0	3	23.5	31
2/10/2010 10:32	1294	240	139	97	58	32	15	1	0	3	23.6	31
2/10/2010 10:33	3079	1062	518	288	103	32	10	1	0	3	23.5	32
2/10/2010 10:34	3616	1318	667	373	149	53	7	0	0	3	23.6	32
2/10/2010 10:35	1546	305	128	74	34	15	6	1	0	3	23.7	31
2/10/2010 10:36	1985	472	219	129	68	27	4	0	0	3	23.6	31
2/10/2010 10:37	1712	395	187	128	69	27	13	2	0	3	23.7	31
2/10/2010 10:38	2509	850	446	284	109	44	11	2	0	3	23.8	32
2/10/2010 10:39	2113	547	266	171	79	23	9	4	0	3	23.7	32
2/10/2010 10:40	1550	321	148	84	33	11	3	0	0	3	23.8	31
2/10/2010 10:41	1443	258	121	78	44	15	3	0	0	3	23.7	31
2/10/2010 10:42	1345	243	107	70	40	16	5	0	0	3	23.8	31
2/10/2010 10:43	1302	230	104	62	39	20	4	0	0	3	23.8	31
2/10/2010 10:44	1343	222	110	78	48	24	5	2	0	3	23.8	32
2/10/2010 10:45	1218	212	95	64	30	9	3	0	0	3	23.9	31
2/10/2010 10:46	1248	223	117	77	28	8	2	0	0	3	23.9	31
2/10/2010 10:47	1185	212	111	74	46	20	6	1	0	3	23.9	31
2/10/2010 10:48	1189	198	88	57	25	9	4	2	0	3	23.8	31
2/10/2010 10:49	1161	174	69	48	20	7	3	0	0	3	24	31
2/10/2010 10:50	1146	160	68	38	15	4	3	0	0	3	23.9	31
2/10/2010 10:51	1106	188	97	62	33	8	2	1	0	3	24	31
2/10/2010 10:52	1061	174	92	60	33	20	7	2	0	3	24	31
2/10/2010 10:53	1884	548	286	171	71	19	4	0	0	3	24	31
2/10/2010 10:54	19397	8581	4099	2052	586	140	40	4	0	3	24	32

2/10/2010 10:55	1949	586	315	217	113	43	15	3	0	3	24.1	32
2/10/2010 10:56	1227	245	152	109	60	27	7	0	0	3	24.1	31
2/10/2010 10:57	1238	237	138	110	56	21	12	5	0	3	24.1	31
2/10/2010 10:58	1282	286	172	128	82	37	17	1	0	3	24.1	31
2/10/2010 10:59	1338	362	247	192	118	63	25	6	0	3	24.1	31
2/10/2010 11:00	1253	266	177	140	87	37	19	4	0	3	24.1	31
2/10/2010 11:01	4267	1697	864	517	210	81	23	7	0	3	24.2	32
2/10/2010 11:02	1539	460	286	217	116	55	15	0	0	3	24.2	31
2/10/2010 11:03	1633	593	370	247	128	59	17	2	0	3	24.2	31
2/10/2010 11:04	1679	522	312	216	109	43	16	2	0	3	24.2	31
2/10/2010 11:05	1264	288	176	129	72	35	10	0	0	3	24.2	31
2/10/2010 11:06	1320	350	231	187	125	68	37	9	0	3	24.2	31
2/10/2010 11:07	1167	253	152	107	50	24	10	2	0	3	24.3	31
2/10/2010 11:08	1111	214	124	92	50	16	5	2	0	3	24.3	31
2/10/2010 11:09	1134	227	135	92	53	21	11	1	0	3	24.1	30
2/10/2010 11:10	1172	257	145	101	51	22	8	1	0	3	24.3	31
2/10/2010 11:11	1185	253	140	102	58	32	13	2	0	3	24.3	31
2/10/2010 11:12	1195	237	141	99	60	31	12	2	0	3	24.3	31
2/10/2010 11:13	1268	312	199	128	64	23	9	1	0	3	24.4	31
2/10/2010 11:14	1763	617	379	281	132	53	15	2	0	3	24.4	30
2/10/2010 11:15	1438	430	274	189	93	30	14	1	0	3	24.3	30
2/10/2010 11:16	1544	449	278	193	94	37	13	2	0	3	24.4	30
2/10/2010 11:17	1272	324	180	111	56	23	8	0	0	3	24.4	30
2/10/2010 11:18	1182	263	165	109	65	29	8	0	0	3	24.4	30
2/10/2010 11:19	1156	263	150	113	64	23	9	2	0	3	24.4	30
2/10/2010 11:20	1171	225	124	89	57	18	6	1	0	3	24.3	30
2/10/2010 11:21	1145	248	148	106	59	27	6	1	0	3	24.4	30
2/10/2010 11:22	1165	244	147	107	59	32	9	1	0	3	24.4	30
2/10/2010 11:23	1038	205	113	76	45	16	4	0	0	3	24.4	30
2/10/2010 11:24	1142	198	101	72	45	13	5	0	0	3	24.4	30

2/10/2010 11:25	1237	280	186	138	74	35	16	4	0	3	24.4	30
2/10/2010 11:26	1336	324	209	154	96	41	17	3	0	3	24.4	31
2/10/2010 11:27	1182	251	153	111	56	27	5	2	0	3	24.5	30
2/10/2010 11:28	1209	252	134	102	59	26	11	0	0	3	24.4	30
2/10/2010 11:29	1287	327	180	135	85	38	10	1	0	3	24.4	30
2/10/2010 11:30	1245	252	143	102	47	19	11	1	0	3	24.5	31
2/10/2010 11:31	1228	281	174	128	80	37	8	2	0	3	24.4	31
2/10/2010 11:32	1308	295	180	135	78	37	13	3	0	3	24.4	30
2/10/2010 11:33	1334	344	213	165	95	49	16	3	0	3	24.5	30
2/10/2010 11:34	1344	363	239	184	98	45	13	5	0	3	24.5	30
2/10/2010 11:35	1434	382	237	179	98	38	15	1	0	3	24.5	30
2/10/2010 11:36	1388	368	241	183	104	40	13	1	0	3	24.5	30
2/10/2010 11:37	1383	411	257	192	110	57	27	1	0	3	24.4	30
2/10/2010 11:38	1433	393	263	206	119	60	18	1	0	3	24.5	31
2/10/2010 11:39	1444	469	334	253	168	79	29	6	0	3	24.5	30
2/10/2010 11:40	1360	388	261	204	131	59	23	4	0	3	24.5	30
2/10/2010 11:41	1771	714	518	392	227	75	23	3	0	3	24.5	30
2/10/2010 11:42	1684	648	437	329	193	75	31	5	0	3	24.5	30
2/10/2010 11:43	1585	589	427	321	182	76	25	6	0	3	24.6	31
2/10/2010 11:44	1561	590	403	322	174	83	25	6	0	3	24.5	30
2/10/2010 11:45	2949	1332	806	533	262	78	20	4	0	3	24.6	32
2/10/2010 11:46	3554	1586	900	592	245	77	25	5	0	3	24.4	31
2/10/2010 11:47	1585	575	384	289	159	69	25	2	0	3	24.6	31
2/10/2010 11:48	1460	478	316	235	125	51	18	2	0	3	24.5	31
2/10/2010 11:49	1776	707	487	377	222	85	26	4	0	3	24.6	31
2/10/2010 11:50	1650	618	415	293	169	78	22	2	0	3	24.5	31
2/10/2010 11:51	2629	1122	715	489	251	114	39	4	0	3	24.6	31
2/10/2010 11:52	1681	606	413	308	185	74	29	6	0	3	24.6	30
2/10/2010 11:53	1739	674	473	364	210	78	34	3	0	3	24.6	31
2/10/2010 11:54	2102	936	658	511	278	115	57	18	0	3	24.6	30

2/10/2010 11:55	1966	867	595	451	264	109	40	7	0	3	24.6	30
2/10/2010 11:56	1807	772	544	408	226	83	25	4	0	3	24.6	31
2/10/2010 11:57	1765	746	504	373	218	101	40	11	0	3	24.6	31
2/10/2010 11:58	1610	598	419	314	187	79	30	5	0	3	24.6	30
2/10/2010 11:59	1624	629	444	341	192	80	29	9	0	3	24.6	31
2/10/2010 12:00	1565	558	399	303	181	82	29	6	0	3	24.6	30
2/10/2010 12:01	7316	3374	1786	1058	378	122	33	5	0	3	24.6	32
2/10/2010 12:02	3201	1386	814	514	224	84	26	7	0	3	24.5	30
2/10/2010 12:03	2099	859	508	367	177	73	27	6	0	3	24.5	31
2/10/2010 12:04	1486	483	321	232	124	38	12	2	0	3	24.6	30
2/10/2010 12:05	1387	393	251	180	106	44	14	2	0	3	24.6	30
2/10/2010 12:06	1434	507	338	236	123	51	11	2	0	3	24.6	30
2/10/2010 12:07	3107	1469	967	669	329	119	40	6	0	3	24.6	32
2/10/2010 12:08	2287	1013	650	438	221	76	18	2	0	3	24.6	31
2/10/2010 12:09	11866	5560	2889	1658	536	128	35	3	0	3	24.6	32
2/10/2010 12:10	1786	650	392	265	139	65	22	5	0	3	24.6	31
2/10/2010 12:11	1329	395	283	213	131	56	17	1	0	3	24.5	30
2/10/2010 12:12	1204	304	202	160	83	31	7	1	0	3	24.6	30
2/10/2010 12:13	1241	385	267	197	117	58	20	5	0	3	24.6	30
2/10/2010 12:14	1229	362	258	195	108	57	20	1	0	3	24.6	30
2/10/2010 12:15	1188	343	232	172	105	45	17	3	0	3	24.6	30
2/10/2010 12:16	1322	412	281	206	123	51	16	3	0	3	24.5	30
2/10/2010 12:17	21785	14149	9421	6419	2837	801	210	15	0	3	24.5	31
2/10/2010 12:18	4419	2487	1617	1146	524	158	43	7	0	3	24.5	31
2/10/2010 12:19	4718	2644	1797	1252	605	204	66	11	0	3	24.5	30
2/10/2010 12:20	2016	862	566	419	227	79	26	4	0	3	24.4	30
2/10/2010 12:21	2203	1015	690	503	270	116	42	6	0	3	24.5	30

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/10/2010 13:22	766	139	106	90	60	33	13	4	0	3	24.4	30
2/10/2010 13:23	780	122	79	62	45	16	8	3	0	3	24.4	30
2/10/2010 13:24	817	134	94	74	51	28	10	3	0	3	24.5	30
2/10/2010 13:25	870	168	122	101	62	31	15	4	0	3	24.4	30
2/10/2010 13:26	926	171	102	81	56	29	7	0	0	3	24.4	30
2/10/2010 13:27	851	167	114	87	56	27	12	1	0	3	24.5	30
2/10/2010 13:28	887	177	123	104	75	40	19	4	0	3	24.5	30
2/10/2010 13:29	931	206	160	134	94	46	13	3	0	3	24.5	30
2/10/2010 13:30	976	260	186	160	109	57	21	8	0	3	24.5	30
2/10/2010 13:31	917	209	151	125	72	37	18	8	0	3	24.6	30
2/10/2010 13:32	942	234	164	142	99	59	19	6	0	3	24.5	30
2/10/2010 13:33	926	190	133	100	69	31	11	2	0	3	24.5	30
2/10/2010 13:34	907	187	124	95	59	29	11	1	0	3	24.5	30
2/10/2010 13:35	843	163	110	83	58	26	9	1	0	3	24.5	30
2/10/2010 13:36	882	180	127	101	69	42	11	0	0	3	24.5	30
2/10/2010 13:37	891	179	131	103	55	38	15	2	0	3	24.5	30
2/10/2010 13:38	851	149	96	82	59	29	8	1	0	3	24.6	30
2/10/2010 13:39	945	170	109	79	44	20	5	1	0	3	24.6	30
2/10/2010 13:40	937	180	117	90	61	29	10	2	0	3	24.6	30
2/10/2010 13:41	864	167	101	79	46	29	10	2	0	3	24.5	30
2/10/2010 13:42	918	178	117	102	69	39	18	2	0	3	24.6	30
2/10/2010 13:43	960	175	120	90	63	33	10	0	0	3	24.4	30
2/10/2010 13:44	934	195	139	115	65	32	14	2	0	3	24.6	30
2/10/2010 13:45	918	160	108	82	49	27	12	3	0	3	24.6	30
2/10/2010 13:46	884	129	79	67	51	26	7	1	0	3	24.6	30
2/10/2010 13:47	932	206	156	130	80	42	13	2	0	3	24.5	30
2/10/2010 13:48	900	170	124	97	61	30	11	0	0	3	24.6	30
2/10/2010 13:49	850	130	89	66	40	21	10	0	0	3	24.5	30

2/10/2010 13:50	868	184	130	110	75	51	19	7	0	3	24.6	30
2/10/2010 13:51	927	200	150	127	85	39	11	2	0	3	24.6	30
2/10/2010 13:52	895	194	138	113	70	32	15	5	0	3	24.6	30
2/10/2010 13:53	845	183	119	101	75	40	18	3	0	3	24.6	30
2/10/2010 13:54	838	151	96	74	41	22	5	0	0	3	24.6	30
2/10/2010 13:55	854	158	91	70	48	30	12	2	0	3	24.7	30
2/10/2010 13:56	880	173	122	101	69	32	9	2	0	3	24.6	30
2/10/2010 13:57	820	179	115	89	60	28	10	2	0	3	24.6	30
2/10/2010 13:58	924	218	164	133	97	51	22	3	0	3	24.7	30
2/10/2010 13:59	888	198	131	110	74	36	15	3	0	3	24.7	30
2/10/2010 14:00	1753	678	419	285	142	62	29	6	0	3	24.6	30
2/10/2010 14:01	1431	498	296	216	141	68	26	3	0	3	24.7	30
2/10/2010 14:02	896	194	135	116	78	39	11	4	0	3	24.7	30
2/10/2010 14:03	920	228	153	135	94	41	12	4	0	3	24.7	30
2/10/2010 14:04	890	184	117	97	59	33	15	2	0	3	24.7	31
2/10/2010 14:05	840	176	129	104	66	35	18	3	0	3	24.7	31
2/10/2010 14:06	913	177	117	93	59	30	12	1	0	3	24.7	30
2/10/2010 14:07	910	212	144	119	85	42	20	5	0	3	24.7	30
2/10/2010 14:08	923	214	154	129	87	43	10	2	0	3	24.7	30
2/10/2010 14:09	1037	289	214	186	126	73	28	10	0	3	24.7	30
2/10/2010 14:10	968	233	173	143	97	44	20	5	0	3	24.6	30
2/10/2010 14:11	949	235	164	129	82	50	19	3	0	3	24.7	30
2/10/2010 14:12	933	204	138	108	73	38	12	5	0	3	24.8	31
2/10/2010 14:13	990	246	155	121	83	40	12	2	0	3	24.8	30
2/10/2010 14:14	907	187	119	93	58	37	19	2	0	3	24.7	30
2/10/2010 14:15	814	170	123	100	67	35	12	2	0	3	24.7	30
2/10/2010 14:16	931	199	141	114	73	34	11	0	0	3	24.6	30
2/10/2010 14:17	848	163	105	83	55	26	8	1	0	3	24.7	30
2/10/2010 14:18	832	166	100	84	51	27	7	1	0	3	24.7	31
2/10/2010 14:19	821	161	105	84	42	23	6	0	0	3	24.8	30

2/10/2010 14:20	862	153	96	72	42	19	5	1	0	3	24.7	30
2/10/2010 14:21	868	128	85	61	39	24	7	2	0	3	24.8	30
2/10/2010 14:22	838	154	94	65	35	18	5	1	0	3	24.8	30
2/10/2010 14:23	894	158	92	74	39	19	7	2	0	3	24.8	30
2/10/2010 14:24	886	174	101	80	44	23	9	0	0	3	24.8	30
2/10/2010 14:25	885	159	92	74	51	31	21	2	0	3	24.8	30
2/10/2010 14:26	837	134	79	62	44	26	8	2	0	3	24.7	30
2/10/2010 14:27	805	130	72	53	33	16	8	2	0	3	24.8	30
2/10/2010 14:28	876	144	89	61	37	21	7	1	0	3	24.8	30
2/10/2010 14:29	869	163	80	59	41	12	1	0	0	3	24.7	30
2/10/2010 14:30	872	135	71	54	35	15	6	2	0	3	24.9	30
2/10/2010 14:31	796	121	63	49	33	20	5	1	0	3	24.7	30
2/10/2010 14:32	804	138	91	67	44	15	4	1	0	3	24.8	30
2/10/2010 14:33	872	172	121	91	64	33	10	3	0	3	24.8	30
2/10/2010 14:34	821	165	108	86	56	28	8	1	0	3	24.9	30
2/10/2010 14:35	892	230	172	132	91	42	17	3	0	3	24.9	30
2/10/2010 14:36	871	204	150	125	85	44	13	3	0	3	24.8	30
2/10/2010 14:37	874	225	166	144	93	51	14	1	0	3	24.8	30
2/10/2010 14:38	920	253	194	162	110	53	21	5	0	3	24.8	30
2/10/2010 14:39	882	235	178	153	108	57	21	4	0	3	24.9	30
2/10/2010 14:40	857	198	140	109	69	30	14	4	0	3	24.8	30
2/10/2010 14:41	870	185	127	110	69	33	10	1	0	3	24.9	30
2/10/2010 14:42	781	150	104	91	56	32	11	1	0	3	24.9	30
2/10/2010 14:43	836	135	93	71	48	26	14	1	0	3	24.8	30
2/10/2010 14:44	844	138	96	83	56	29	10	0	0	3	24.8	30
2/10/2010 14:45	884	184	129	100	65	31	10	2	0	3	24.8	30
2/10/2010 14:46	1016	269	213	163	120	58	17	0	0	3	24.9	31
2/10/2010 14:47	1002	252	180	150	105	50	17	2	0	3	24.8	30
2/10/2010 14:48	927	210	155	126	90	56	25	5	0	3	24.8	30
2/10/2010 14:49	851	166	117	90	57	36	11	2	0	3	24.8	31

2/10/2010 14:50	878	183	138	105	69	36	13	1	0	3	24.9	31
2/10/2010 14:51	855	187	133	113	70	38	12	3	0	3	24.8	30
2/10/2010 14:52	837	172	115	88	55	24	13	2	0	3	24.8	30
2/10/2010 14:53	851	159	117	88	56	26	10	2	0	3	24.9	30
2/10/2010 14:54	897	182	127	106	67	36	18	2	0	3	24.8	30
2/10/2010 14:55	915	178	123	100	69	36	15	4	0	3	24.9	30
2/10/2010 14:56	881	153	104	87	61	31	10	1	0	3	24.9	30
2/10/2010 14:57	880	138	92	75	46	15	7	0	0	3	24.9	30
2/10/2010 14:58	896	138	89	66	41	18	3	0	0	3	24.9	30
2/10/2010 14:59	971	168	103	80	45	26	8	1	0	3	24.9	30
2/10/2010 15:00	1062	196	120	93	62	36	12	0	0	3	24.9	30
2/10/2010 15:01	1100	281	189	150	95	35	18	6	0	3	24.8	30
2/10/2010 15:02	1407	469	323	249	158	61	23	4	0	3	24.7	30
2/10/2010 15:03	1404	438	296	223	137	53	14	3	0	3	24.9	30
2/10/2010 15:04	1218	315	194	144	79	42	11	2	0	3	24.7	30
2/10/2010 15:05	1129	244	157	116	59	27	10	1	0	3	24.8	30
2/10/2010 15:06	1124	244	134	107	64	23	8	1	0	3	24.8	30
2/10/2010 15:07	1200	273	173	138	84	41	13	4	0	3	24.8	30
2/10/2010 15:08	1056	205	114	92	52	27	11	1	0	3	24.9	30
2/10/2010 15:09	1036	215	142	115	72	26	9	0	0	3	24.8	30
2/10/2010 15:10	1389	439	283	217	133	55	21	3	0	3	24.9	30
2/10/2010 15:11	1319	426	286	207	119	49	16	2	0	3	24.8	30
2/10/2010 15:12	1022	232	136	102	59	26	9	2	0	3	24.8	31
2/10/2010 15:13	971	191	118	87	49	21	5	0	0	3	24.9	30
2/10/2010 15:14	967	160	90	65	41	18	8	3	0	3	24.8	30
2/10/2010 15:15	899	152	86	68	38	15	5	1	0	3	24.8	31
2/10/2010 15:16	1006	275	190	155	97	51	22	5	0	3	24.9	30
2/10/2010 15:17	1182	405	307	249	175	82	29	4	0	3	24.8	30
2/10/2010 15:18	974	182	119	88	62	35	15	4	0	3	24.9	30
2/10/2010 15:19	895	232	166	135	92	54	20	4	0	3	24.9	30

2/10/2010 15:20	882	202	142	110	68	39	12	2	0	3	24.9	31
2/10/2010 15:21	923	204	145	114	73	36	14	1	0	3	24.8	30
2/10/2010 15:22	921	193	130	105	61	21	14	3	0	3	24.8	30
2/10/2010 15:23	1045	316	205	157	99	45	14	5	0	3	24.8	30
2/10/2010 15:24	1186	413	283	222	149	71	35	10	0	3	24.8	30
2/10/2010 15:25	1059	320	224	180	92	50	16	1	0	3	24.9	31
2/10/2010 15:26	1216	440	316	244	145	73	27	3	0	3	24.9	31
2/10/2010 15:27	1096	349	235	177	101	53	21	5	0	3	24.9	30
2/10/2010 15:28	1156	433	306	250	156	67	24	4	0	3	24.9	30
2/10/2010 15:29	1191	468	355	285	163	75	23	3	0	3	24.9	31
2/10/2010 15:30	1119	428	323	273	170	90	34	7	0	3	24.9	30
2/10/2010 15:31	1130	449	342	281	174	85	34	7	0	3	24.7	31
2/10/2010 15:32	1018	347	253	182	111	46	16	2	0	3	24.9	30
2/10/2010 15:33	932	310	215	165	105	57	26	4	0	3	24.9	31
2/10/2010 15:34	967	330	231	181	109	60	20	3	0	3	24.9	30
2/10/2010 15:35	1009	349	264	212	134	69	27	4	0	3	24.7	31
2/10/2010 15:36	1113	504	402	349	251	138	65	11	0	3	24.9	30
2/10/2010 15:37	946	314	243	202	139	67	28	9	0	3	24.8	30
2/10/2010 15:38	969	307	233	193	131	61	14	2	0	3	24.9	31
2/10/2010 15:39	944	318	236	197	131	69	21	5	0	3	24.9	31
2/10/2010 15:40	818	262	193	162	124	67	17	2	0	3	24.9	30
2/10/2010 15:41	918	326	248	206	133	68	20	5	0	3	24.8	30
2/10/2010 15:42	1112	457	345	304	206	109	45	8	0	3	24.9	31
2/10/2010 15:43	1049	412	312	254	161	75	29	2	0	3	24.8	30
2/10/2010 15:44	1178	500	384	316	192	93	37	9	0	3	24.9	30
2/10/2010 15:45	1208	534	403	326	201	85	28	2	0	3	24.9	30
2/10/2010 15:46	1039	413	297	238	140	56	13	0	0	3	24.9	31
2/10/2010 15:47	1046	398	274	214	121	55	23	6	0	3	24.9	31
2/10/2010 15:48	961	358	242	202	115	53	21	3	0	3	24.8	31
2/10/2010 15:49	1031	357	261	194	116	55	21	2	0	3	24.9	30

2/10/2010 15:50	945	313	235	174	105	39	17	5	0	3	24.8	31
2/10/2010 15:51	1312	611	468	396	250	118	47	16	0	3	24.9	30
2/10/2010 15:52	1374	699	536	430	256	137	47	9	0	3	24.9	31
2/10/2010 15:53	1190	550	429	345	217	104	31	4	0	3	24.8	30
2/10/2010 15:54	1338	616	455	362	234	96	36	5	0	3	24.9	30
2/10/2010 15:55	1257	503	384	294	201	90	33	5	0	3	24.8	31
2/10/2010 15:56	1364	586	435	357	223	104	38	4	0	3	24.9	31
2/10/2010 15:57	1284	534	390	311	201	96	32	6	0	3	24.8	31
2/10/2010 15:58	1384	607	451	376	229	97	40	7	0	3	24.9	31
2/10/2010 15:59	1375	612	456	355	228	100	35	5	0	3	24.8	31
2/10/2010 16:00	1410	641	473	369	228	97	33	6	0	3	24.8	31
2/10/2010 16:01	1250	501	384	322	192	88	35	7	0	3	24.8	31
2/10/2010 16:02	1303	525	383	289	192	95	39	6	0	3	24.9	30
2/10/2010 16:03	1278	536	412	329	216	96	30	8	0	3	24.9	31
2/10/2010 16:04	1255	500	373	300	199	94	30	4	0	3	24.8	31
2/10/2010 16:05	1220	514	391	314	195	112	39	5	0	3	24.8	31
2/10/2010 16:06	1070	389	294	236	150	71	34	3	0	3	24.8	30
2/10/2010 16:07	1079	368	259	212	130	51	19	0	0	3	24.9	30
2/10/2010 16:08	1016	368	264	198	127	50	19	2	0	3	24.9	30
2/10/2010 16:09	954	327	228	180	108	53	20	7	0	3	24.9	31
2/10/2010 16:10	1031	377	263	209	130	57	18	5	0	3	24.9	31
2/10/2010 16:11	1162	493	368	283	163	78	32	9	0	3	24.8	31
2/10/2010 16:12	1159	486	363	275	175	78	33	7	0	3	24.8	30
2/10/2010 16:13	1131	437	306	229	142	57	24	3	0	3	24.9	31
2/10/2010 16:14	1060	417	289	219	133	65	22	3	0	3	24.8	31
2/10/2010 16:15	916	304	194	160	87	40	16	2	0	3	24.8	30
2/10/2010 16:16	997	380	267	198	108	52	19	4	0	3	24.7	31
2/10/2010 16:17	842	267	177	138	85	43	13	1	0	3	24.8	30
2/10/2010 16:18	940	309	221	175	111	47	12	5	0	3	24.8	30
2/10/2010 16:19	1251	613	431	341	195	80	28	3	0	3	24.8	30

2/10/2010 16:20	2168	1236	947	768	479	206	65	9	0	3	24.8	31
2/10/2010 16:21	1371	608	416	300	174	73	18	3	0	3	24.8	31
2/10/2010 16:22	948	338	240	193	117	58	20	5	0	3	24.7	30
2/10/2010 16:23	923	290	194	146	84	35	12	2	0	3	24.7	31
2/10/2010 16:24	2161	1227	853	619	320	93	16	2	0	3	24.7	31
2/10/2010 16:25	2226	1232	830	599	293	104	38	5	0	3	24.7	31
2/10/2010 16:26	2345	1250	847	606	284	91	26	0	0	3	24.7	31
2/10/2010 16:27	3373	1914	1341	935	462	144	34	3	0	3	24.8	30

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/11/2010 13:02	3044	594	364	253	148	58	20	3	12	1.9	25.9	31
2/11/2010 13:03	3157	655	402	302	187	89	33	10	12	1.9	26	32
2/11/2010 13:04	4548	1025	690	520	316	150	63	24	12	1.9	26.2	32
2/11/2010 13:05	4006	799	489	369	218	122	52	9	12	1.9	26.3	32
2/11/2010 13:06	3744	838	548	388	244	121	52	12	12	1.9	26.4	32
2/11/2010 13:07	3270	685	450	339	186	92	43	12	12	1.9	26.4	32
2/11/2010 13:08	3573	733	462	337	190	101	33	6	12	1.9	26.6	31
2/11/2010 13:09	3607	858	566	409	242	112	45	9	12	1.9	26.7	31
2/11/2010 13:10	3494	724	425	321	175	86	37	12	12	1.9	26.8	31
2/11/2010 13:11	3110	624	418	313	176	94	33	10	12	1.9	26.8	32
2/11/2010 13:12	4215	1450	1044	791	527	252	83	10	12	1.9	26.9	31
2/11/2010 13:13	2981	547	331	227	142	65	20	2	12	1.9	27	31
2/11/2010 13:14	3290	605	357	269	164	84	34	13	12	1.9	27.1	31
2/11/2010 13:15	3275	617	373	265	156	61	24	6	12	1.9	27.1	31
2/11/2010 13:16	3266	644	379	287	169	81	33	11	12	1.9	27.2	31
2/11/2010 13:17	3337	703	430	322	189	100	35	9	12	1.9	27.3	31

2/11/2010 13:18	3055	562	339	238	135	70	29	11	12	1.9	27.2	31
2/11/2010 13:19	2824	481	265	177	104	45	17	2	12	1.9	27.4	31
2/11/2010 13:20	2878	504	279	197	104	48	19	3	12	1.9	27.4	31
2/11/2010 13:21	2909	546	330	253	141	68	28	6	12	1.9	27.5	31
2/11/2010 13:22	2884	497	268	179	113	43	16	2	12	1.9	27.5	31
2/11/2010 13:23	3258	780	472	346	208	102	41	10	12	1.9	27.5	31
2/11/2010 13:24	2897	593	351	263	166	82	28	6	12	1.9	27.7	31
2/11/2010 13:25	2791	497	271	189	102	51	23	5	12	1.9	27.7	31
2/11/2010 13:26	3079	548	299	195	102	51	19	2	12	1.9	27.7	30
2/11/2010 13:27	4572	950	493	304	163	74	27	6	12	1.9	27.8	31
2/11/2010 13:28	3251	604	327	221	118	48	14	3	12	1.9	27.8	30
2/11/2010 13:29	2823	586	295	200	113	57	19	6	12	1.9	27.9	30
2/11/2010 13:30	3475	681	327	199	104	58	22	5	12	1.9	27.9	30
2/11/2010 13:31	3180	635	317	208	112	61	19	6	12	1.9	28	30
2/11/2010 13:32	3775	813	409	252	127	51	19	4	12	1.9	28	30
2/11/2010 13:33	3583	785	382	248	122	46	17	4	12	1.9	28.1	31
2/11/2010 13:34	3843	826	370	236	104	47	16	2	12	1.9	28.1	30
2/11/2010 13:35	3486	743	359	229	110	50	13	4	12	1.9	28.2	30
2/11/2010 13:36	3443	722	355	222	109	66	19	1	12	1.9	28.2	30
2/11/2010 13:37	3649	773	368	202	100	45	14	5	12	1.9	28.3	30
2/11/2010 13:38	3552	758	370	218	104	41	19	3	12	1.9	28.3	30
2/11/2010 13:39	2731	599	335	236	129	57	20	5	12	1.9	28.3	30
2/11/2010 13:40	2839	670	328	200	122	56	25	3	12	1.9	28.3	30
2/11/2010 13:41	3432	763	364	226	88	42	17	4	12	1.9	28.4	30
2/11/2010 13:42	3230	725	351	221	110	46	18	3	12	1.9	28.3	30
2/11/2010 13:43	3141	696	337	205	98	50	11	3	12	1.9	28.4	30
2/11/2010 13:44	2864	735	421	288	157	74	28	5	12	1.9	28.4	30
2/11/2010 13:45	2640	686	386	257	166	72	28	5	12	1.9	28.4	30
2/11/2010 13:46	4083	1135	503	277	113	51	9	1	12	1.9	28.4	30
2/11/2010 13:47	5546	1723	710	365	128	58	23	5	12	1.9	28.5	30

2/11/2010 13:48	4395	1257	522	286	108	46	17	4	12	1.9	28.5	30
2/11/2010 13:49	3431	900	400	221	108	50	19	3	12	1.9	28.5	30
2/11/2010 13:50	3555	923	424	235	115	55	20	5	12	1.9	28.6	30
2/11/2010 13:51	3251	858	406	239	123	66	32	12	12	1.9	28.6	30
2/11/2010 13:52	3795	993	463	258	121	57	26	7	12	1.9	28.6	30
2/11/2010 13:53	3894	1016	436	229	110	53	13	1	12	1.9	28.7	30
2/11/2010 13:54	4001	1091	488	279	130	49	22	7	12	1.9	28.7	30
2/11/2010 13:55	3626	902	409	236	108	52	21	3	12	1.9	28.7	30
2/11/2010 13:56	2951	714	357	214	106	54	19	4	12	1.9	28.7	30
2/11/2010 13:57	2724	681	342	195	91	35	19	5	12	1.9	28.8	30
2/11/2010 13:58	4729	1591	800	473	193	71	21	3	12	1.9	28.8	30
2/11/2010 13:59	4887	1688	833	481	202	68	25	4	12	1.9	28.7	30
2/11/2010 14:00	3957	1288	632	391	185	71	22	5	12	1.9	28.7	30
2/11/2010 14:01	3038	901	446	275	119	57	15	4	12	1.9	28.8	29
2/11/2010 14:02	3583	1175	559	337	155	55	15	3	12	1.9	28.9	30
2/11/2010 14:03	2867	804	407	252	134	66	22	3	12	1.9	28.8	30
2/11/2010 14:04	2387	657	346	215	133	50	17	1	12	1.9	28.8	30
2/11/2010 14:05	2407	661	318	210	95	41	17	2	12	1.9	28.9	30
2/11/2010 14:06	2500	638	322	208	96	39	15	2	12	1.9	28.8	30
2/11/2010 14:07	3028	909	452	282	147	64	18	4	12	1.9	28.9	30
2/11/2010 14:08	2714	766	387	223	117	51	15	6	12	1.9	28.9	29
2/11/2010 14:09	2192	520	246	131	68	34	11	2	12	1.9	28.9	29
2/11/2010 14:10	2323	623	317	200	99	43	12	0	12	1.9	29	30
2/11/2010 14:11	2312	659	345	223	119	49	24	8	12	1.9	28.9	30
2/11/2010 14:12	2126	523	255	151	67	35	13	4	12	1.9	29	30
2/11/2010 14:13	1754	394	178	117	59	27	12	6	12	1.9	28.9	30
2/11/2010 14:14	1619	368	186	133	69	37	20	3	12	1.9	29.1	30
2/11/2010 14:15	1580	384	194	129	64	27	8	2	12	1.9	29.1	30
2/11/2010 14:16	1621	439	267	197	116	59	15	6	12	1.9	29.1	30
2/11/2010 14:17	1785	465	244	169	95	53	17	2	12	1.9	29.1	30

2/11/2010 14:18	2530	679	309	199	100	44	21	8	12	1.9	29.1	30
2/11/2010 14:19	2640	743	345	223	103	49	24	5	12	1.9	29.1	30
2/11/2010 14:20	2623	784	378	237	111	51	18	4	12	1.9	29.1	30
2/11/2010 14:21	1891	500	276	168	90	39	15	2	12	1.9	29.1	30
2/11/2010 14:22	1567	370	199	144	90	43	15	4	12	1.9	29.1	30
2/11/2010 14:23	1898	509	250	166	84	42	19	4	12	1.9	29.2	30
2/11/2010 14:24	2418	626	287	178	79	33	21	3	12	1.9	29.1	30
2/11/2010 14:25	2096	565	275	178	91	36	15	4	12	1.9	29.2	30
2/11/2010 14:26	1822	507	280	193	103	61	26	5	12	1.9	29.2	30
2/11/2010 14:27	2122	616	342	237	139	69	30	6	12	1.9	29.2	29
2/11/2010 14:28	2504	731	371	258	130	56	27	3	12	1.9	29.2	30
2/11/2010 14:29	2154	879	562	424	251	124	43	6	12	1.9	29.1	30
2/11/2010 14:30	1802	575	357	246	128	67	29	8	12	1.9	29.2	30
2/11/2010 14:31	1565	411	239	170	100	52	22	3	12	1.9	29.2	30
2/11/2010 14:32	1637	471	273	188	111	62	18	5	12	1.9	29.2	30
2/11/2010 14:33	1792	561	332	238	146	68	32	8	12	1.9	29.2	30
2/11/2010 14:34	1580	456	277	187	130	55	23	2	12	1.9	29.2	30
2/11/2010 14:35	1740	599	384	299	174	80	35	4	12	1.9	29.2	30
2/11/2010 14:36	1775	589	368	271	163	77	31	4	12	1.9	29.3	30
2/11/2010 14:37	1657	499	304	230	141	69	22	8	12	1.9	29.3	30
2/11/2010 14:38	1662	484	292	193	114	53	17	3	12	1.9	29.4	29
2/11/2010 14:39	1646	431	278	204	127	56	21	6	12	1.9	29.3	29
2/11/2010 14:40	1547	467	271	186	114	55	23	6	12	1.9	29.3	29
2/11/2010 14:41	1515	452	278	217	124	57	22	7	12	1.9	29.3	30
2/11/2010 14:42	1727	572	375	263	163	85	38	9	12	1.9	29.4	30
2/11/2010 14:43	1891	665	410	283	157	70	34	8	12	1.9	29.3	30
2/11/2010 14:44	1709	616	408	300	170	82	30	4	12	1.9	29.3	30
2/11/2010 14:45	1736	590	394	293	169	78	27	5	12	1.9	29.3	30
2/11/2010 14:46	1645	590	389	285	172	85	31	8	12	1.9	29.4	29
2/11/2010 14:47	2440	986	609	404	219	87	29	8	12	1.9	29.3	29

2/11/2010 14:48	1840	683	426	300	166	80	30	6	12	1.9	29.2	30
2/11/2010 14:49	1916	705	465	333	182	75	29	7	12	1.9	29.3	30
2/11/2010 14:50	1652	574	372	256	151	72	19	4	12	1.9	29.3	30
2/11/2010 14:51	1880	734	476	344	191	90	29	6	12	1.9	29.3	30
2/11/2010 14:52	1968	891	614	467	278	147	55	14	12	1.9	29.3	30
2/11/2010 14:53	1788	757	534	390	233	107	34	9	12	1.9	29.4	29
2/11/2010 14:54	1810	811	571	427	259	126	54	13	12	1.9	29.4	30
2/11/2010 14:55	1795	742	541	407	227	117	44	7	12	1.9	29.4	29
2/11/2010 14:56	1720	741	452	309	163	82	29	4	12	1.9	29.4	30
2/11/2010 14:57	1636	634	444	291	174	80	35	8	12	1.9	29.3	30
2/11/2010 14:58	1741	589	383	276	168	71	34	7	12	1.9	29.4	30
2/11/2010 14:59	2174	625	425	312	194	92	38	12	12	1.9	29.3	30
2/11/2010 15:00	2014	656	433	324	192	98	46	4	12	1.9	29.5	30
2/11/2010 15:01	1925	655	456	325	204	101	42	17	12	1.9	29.4	30
2/11/2010 15:02	1905	603	399	288	160	70	23	6	12	1.9	29.5	30
2/11/2010 15:03	2112	676	456	328	203	84	22	8	12	1.9	29.4	30
2/11/2010 15:04	1924	632	439	332	181	96	30	7	12	1.9	29.2	30
2/11/2010 15:05	1675	577	421	317	203	104	40	11	12	1.9	29.5	30
2/11/2010 15:06	1929	721	511	391	244	114	39	9	12	1.9	29.4	30
2/11/2010 15:07	1791	638	455	350	207	108	41	8	12	1.9	29.4	30
2/11/2010 15:08	1776	580	394	270	144	60	20	7	12	1.9	29.5	30
2/11/2010 15:09	1712	591	431	322	196	88	29	4	12	1.9	29.5	30
2/11/2010 15:10	1904	725	500	370	202	102	38	2	12	1.9	29.6	30
2/11/2010 15:11	2222	861	563	386	193	85	28	6	12	1.9	29.5	30
2/11/2010 15:12	2690	1266	843	564	283	117	43	8	12	1.9	29.5	29
2/11/2010 15:13	2611	1149	719	496	243	100	39	8	12	1.9	29.6	30
2/11/2010 15:14	3712	1866	1172	760	332	126	38	6	12	1.9	29.4	30
2/11/2010 15:15	3610	1856	1163	738	309	111	36	10	12	1.9	29.4	30
2/11/2010 15:16	3589	1811	1135	759	346	145	53	12	12	1.9	29.5	30
2/11/2010 15:17	3207	1554	977	640	264	110	40	4	12	1.9	29.5	30

2/11/2010 15:18	3044	1362	868	565	281	126	38	8	12	1.9	29.5	30
2/11/2010 15:19	3001	1351	833	533	257	99	38	6	12	1.9	29.5	30
2/11/2010 15:20	2861	1328	844	569	268	109	47	9	12	1.9	29.6	30
2/11/2010 15:21	2547	1144	744	477	223	75	28	3	12	1.9	29.5	30
2/11/2010 15:22	2416	1115	684	424	194	83	32	8	12	1.9	29.6	30
2/11/2010 15:23	4637	2560	1650	1059	425	151	62	11	12	1.9	29.6	30
2/11/2010 15:24	4722	2710	1776	1167	510	178	55	8	12	1.9	29.6	30
2/11/2010 15:25	4789	2667	1732	1120	508	178	45	7	12	1.9	29.6	30
2/11/2010 15:26	3797	1952	1238	801	332	119	41	13	12	1.9	29.6	30
2/11/2010 15:27	3882	2044	1299	817	358	124	39	8	12	1.9	29.5	30
2/11/2010 15:28	3101	1590	1011	665	318	126	46	10	12	1.9	29.5	30
2/11/2010 15:29	3217	1681	1129	780	373	156	57	15	12	1.9	29.6	30
2/11/2010 15:30	3551	1781	1140	750	370	150	57	11	12	1.9	29.6	29
2/11/2010 15:31	3029	1528	1041	706	365	152	60	17	12	1.9	29.5	30
2/11/2010 15:32	3108	1552	1025	747	408	187	77	12	12	1.9	29.6	30
2/11/2010 15:33	3057	1510	1009	708	361	159	55	10	12	1.9	29.6	30
2/11/2010 15:34	2668	1289	859	617	322	135	54	6	12	1.9	29.5	30
2/11/2010 15:35	2597	1282	925	674	395	184	74	23	12	1.9	29.6	30
2/11/2010 15:36	2816	1410	996	731	424	192	76	20	12	1.9	29.6	30
2/11/2010 15:37	2862	1429	1042	782	472	226	81	8	12	1.9	29.6	30
2/11/2010 15:38	2699	1235	865	673	398	191	78	16	12	1.9	29.6	30
2/11/2010 15:39	2532	1041	718	544	315	137	47	8	12	1.9	29.5	30
2/11/2010 15:40	2679	936	564	408	228	105	47	6	12	1.9	29.6	29
2/11/2010 15:41	3345	1034	520	346	198	92	35	10	12	1.9	29.6	30
2/11/2010 15:42	2830	857	509	361	193	90	35	12	12	1.9	29.5	30
2/11/2010 15:43	2709	849	520	372	222	107	47	9	12	1.9	29.6	30
2/11/2010 15:44	2935	904	539	376	197	89	32	7	12	1.9	29.6	30
2/11/2010 15:45	2574	866	562	395	220	113	47	15	12	1.9	29.6	30
2/11/2010 15:46	2803	1072	736	564	359	161	65	11	12	1.9	29.6	30
2/11/2010 15:47	2317	778	523	396	254	105	41	6	12	1.9	29.4	30

2/11/2010 15:48	2544	899	635	481	281	152	69	6	12	1.9	29.6	30
2/11/2010 15:49	4222	1873	1157	796	424	191	62	14	12	1.9	29.5	30
2/11/2010 15:50	8098	4540	2932	1927	936	366	105	13	12	1.9	29.6	30
2/11/2010 15:51	7679	4234	2763	1830	875	378	106	13	12	1.9	29.6	30
2/11/2010 15:52	5427	3006	2108	1543	873	405	126	18	12	1.9	29.6	30
2/11/2010 15:53	4755	2584	1885	1422	817	391	118	14	12	1.9	29.5	30
2/11/2010 15:54	3442	1552	1056	788	442	200	51	11	12	1.9	29.5	30
2/11/2010 15:55	2674	972	630	450	235	105	36	10	12	1.9	29.4	30

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/22/2010 12:52	1490	304	188	122	58	19	8	4	0	3	25.4	48
2/22/2010 12:53	1571	299	178	112	49	19	9	1	0	3	25.7	48
2/22/2010 12:54	1714	314	176	109	43	19	3	2	0	3	26	47
2/22/2010 12:55	1692	288	166	107	49	18	4	1	0	3	26.4	46
2/22/2010 12:56	1766	335	196	137	68	31	17	9	0	3	26.7	46
2/22/2010 12:57	1815	302	182	120	53	18	7	4	0	3	26.9	46
2/22/2010 12:58	1766	282	157	105	41	15	8	4	0	3	27.3	45
2/22/2010 12:59	1851	349	205	138	85	39	19	5	8	3	27.5	45
2/22/2010 13:00	1974	417	273	189	105	54	33	11	8	3	27.7	45
2/22/2010 13:01	1849	342	212	150	91	36	18	7	8	3	27.9	45
2/22/2010 13:02	1801	307	190	141	83	42	11	4	0	3	28	45
2/22/2010 13:03	1850	336	208	145	73	32	15	7	0	3	28.2	45
2/22/2010 13:04	1812	303	193	131	77	37	19	9	0	3	28.4	45
2/22/2010 13:05	1815	281	169	119	65	27	12	2	0	3	28.4	44
2/22/2010 13:06	1779	284	175	126	78	33	16	6	0	3	28.6	44
2/22/2010 13:07	1794	271	162	125	65	27	12	6	0	3	28.7	44

2/22/2010 13:08	1820	271	153	104	58	32	9	2	0	3	28.7	44
2/22/2010 13:09	1852	284	177	115	68	34	18	6	0	3	28.8	44
2/22/2010 13:10	3344	1083	599	362	149	60	22	8	0	3	28.8	44
2/22/2010 13:11	2475	764	507	379	234	125	56	19	0	3	28.9	44
2/22/2010 13:12	2177	425	264	186	100	50	17	7	0	3	29.1	44
2/22/2010 13:13	2146	361	236	164	85	36	17	13	0	3	29.1	44
2/22/2010 13:14	2179	367	207	132	62	20	9	6	0	3	29.2	44
2/22/2010 13:15	2270	430	269	191	111	54	25	9	0	3	29.3	44
2/22/2010 13:16	2322	539	329	239	135	70	30	7	0	3	29.2	44
2/22/2010 13:17	2245	405	244	164	91	42	19	3	0	3	29.2	44
2/22/2010 13:18	2197	397	225	149	81	54	26	10	0	3	29.3	43
2/22/2010 13:19	2224	405	242	179	103	45	13	3	0	3	29.4	43
2/22/2010 13:20	2209	426	253	179	92	41	17	3	0	3	29.4	43
2/22/2010 13:21	2139	401	236	163	101	45	21	3	0	3	29.5	43
2/22/2010 13:22	2047	379	223	151	87	40	20	6	0	3	29.6	43
2/22/2010 13:23	2026	322	189	141	74	35	20	7	0	3	29.5	43
2/22/2010 13:24	1927	317	156	103	52	28	9	4	0	3	29.6	43
2/22/2010 13:25	1974	303	175	125	54	23	13	2	0	3	29.7	43
2/22/2010 13:26	1887	292	159	106	61	22	6	3	0	3	29.7	43
2/22/2010 13:27	1857	254	160	107	55	20	6	1	0	3	29.7	43
2/22/2010 13:28	1756	249	133	85	47	25	11	2	0	3	29.7	43
2/22/2010 13:29	1844	242	140	102	54	18	7	2	0	3	29.7	43
2/22/2010 13:30	1865	280	163	106	66	32	11	2	0	3	29.8	43
2/22/2010 13:31	1817	271	155	104	58	32	7	1	0	3	29.8	43
2/22/2010 13:32	1767	266	158	107	61	33	13	2	0	3	29.8	43
2/22/2010 13:33	1692	227	132	103	66	30	13	1	0	3	29.8	43
2/22/2010 13:34	1681	192	110	68	39	19	9	1	0	3	29.8	42
2/22/2010 13:35	1713	241	135	93	59	28	9	3	0	3	29.8	43
2/22/2010 13:36	1723	214	114	78	49	25	4	1	0	3	29.9	42
2/22/2010 13:37	1727	217	111	75	42	19	7	1	0	3	29.9	42

2/22/2010 13:38	1718	198	116	80	44	12	4	1	0	3	30	42
2/22/2010 13:39	1733	201	99	63	32	12	5	2	0	3	30	42
2/22/2010 13:40	1693	209	96	53	29	16	7	1	0	3	29.9	42
2/22/2010 13:41	1683	184	106	73	35	13	5	0	0	3	30	42
2/22/2010 13:42	1671	206	98	57	30	16	4	0	0	3	30.1	42
2/22/2010 13:43	1634	206	101	69	35	16	8	2	0	3	30	42
2/22/2010 13:44	1663	220	109	61	39	19	7	2	0	3	30.1	42
2/22/2010 13:45	1640	173	90	55	26	11	5	1	0	3	30	42
2/22/2010 13:46	1570	178	91	63	32	17	12	3	0	3	30.1	42
2/22/2010 13:47	1666	190	94	58	33	18	7	1	0	3	30.1	42
2/22/2010 13:48	1685	202	100	68	42	23	7	2	0	3	30	42
2/22/2010 13:49	1674	172	107	65	25	14	5	0	0	3	30.1	42
2/22/2010 13:50	1673	228	128	85	42	21	7	0	0	3	30.2	42
2/22/2010 13:51	1608	194	96	60	31	10	5	0	0	3	30.2	42
2/22/2010 13:52	1736	217	103	63	34	17	8	4	0	3	30.2	42
2/22/2010 13:53	1711	294	184	121	59	25	9	1	0	3	30.1	42
2/22/2010 13:54	1754	310	193	144	83	44	23	8	0	3	30.2	42
2/22/2010 13:55	1748	277	171	114	64	26	10	0	0	3	30.2	42
2/22/2010 13:56	1692	219	120	80	47	29	12	3	0	3	30.2	42
2/22/2010 13:57	1657	210	120	83	49	27	11	1	0	3	30.2	42
2/22/2010 13:58	1543	216	123	80	44	19	7	2	0	3	30.3	42
2/22/2010 13:59	1637	195	104	76	50	26	14	7	0	3	30.3	42
2/22/2010 14:00	1784	251	124	85	51	18	10	6	0	3	30.3	41
2/22/2010 14:01	1705	237	128	86	43	23	8	3	0	3	30.3	42
2/22/2010 14:02	2381	554	268	163	81	39	13	4	0	3	30.4	42
2/22/2010 14:03	2377	623	345	217	121	59	19	3	0	3	30.3	42
2/22/2010 14:04	2062	391	209	139	79	34	17	3	0	3	30.3	42
2/22/2010 14:05	1999	351	168	111	61	29	10	2	0	3	30.4	42
2/22/2010 14:06	2017	361	186	122	68	25	12	7	0	3	30.4	42
2/22/2010 14:07	2124	391	208	131	68	32	14	3	0	3	30.4	41

2/22/2010 14:08	2071	353	183	130	70	33	14	1	0	3	30.4	42
2/22/2010 14:09	2025	334	158	101	46	23	11	5	0	3	30.5	41
2/22/2010 14:10	1955	289	133	90	53	21	12	3	0	3	30.4	42
2/22/2010 14:11	1946	285	141	87	42	19	11	3	0	3	30.4	41
2/22/2010 14:12	1913	281	134	86	47	29	13	8	0	3	30.4	42
2/22/2010 14:13	1913	288	145	97	44	16	8	1	0	3	30.4	42
2/22/2010 14:14	1986	323	164	106	62	29	10	4	0	3	30.5	41
2/22/2010 14:15	1878	279	142	83	38	19	9	2	0	3	30.5	41
2/22/2010 14:16	1947	292	140	99	46	20	13	4	0	3	30.5	41
2/22/2010 14:17	1871	246	120	70	37	15	9	3	0	3	30.5	42
2/22/2010 14:18	1949	308	168	107	54	20	6	1	0	3	30.5	41
2/22/2010 14:19	2149	502	300	215	73	25	8	2	0	3	30.5	41
2/22/2010 14:20	4572	1854	1049	667	298	105	35	12	0	3	30.5	42
2/22/2010 14:21	2150	442	237	170	97	48	14	3	0	3	30.4	41
2/22/2010 14:22	1931	309	148	93	50	20	10	2	0	3	30.5	41
2/22/2010 14:23	1946	308	155	103	60	23	11	3	0	3	30.5	41
2/22/2010 14:24	1964	266	145	100	52	28	9	1	0	3	30.5	41
2/22/2010 14:25	1927	306	141	97	54	31	13	3	0	3	30.5	41
2/22/2010 14:26	1922	255	116	81	44	21	9	1	0	3	30.6	41
2/22/2010 14:27	1821	233	120	80	44	20	7	0	0	3	30.6	41
2/22/2010 14:28	1768	243	109	75	45	19	5	0	0	3	30.6	41
2/22/2010 14:29	1862	236	117	67	39	20	7	1	0	3	30.6	41
2/22/2010 14:30	1838	273	121	72	43	14	3	0	0	3	30.6	41
2/22/2010 14:31	1878	294	151	97	47	20	7	2	0	3	30.6	41
2/22/2010 14:32	1800	257	131	94	47	24	7	1	0	3	30.7	41
2/22/2010 14:33	1891	278	135	91	47	19	8	1	0	3	30.7	41
2/22/2010 14:34	1897	309	176	120	56	28	13	3	0	3	30.7	41
2/22/2010 14:35	1970	289	150	106	57	24	11	2	0	3	30.6	41
2/22/2010 14:36	1953	334	178	122	70	35	18	5	0	3	30.7	41
2/22/2010 14:37	1859	272	152	105	53	22	10	2	0	3	30.7	41

2/22/2010 14:38	1853	293	153	95	48	27	6	1	0	3	30.7	41
2/22/2010 14:39	1977	313	159	99	53	22	10	5	0	3	30.7	41
2/22/2010 14:40	2180	504	317	232	134	65	21	3	0	3	30.6	41
2/22/2010 14:41	2103	404	214	141	82	47	14	4	0	3	30.7	41
2/22/2010 14:42	2141	449	251	172	98	48	20	4	0	3	30.6	41
2/22/2010 14:43	2117	443	238	171	94	57	22	5	0	3	30.7	41
2/22/2010 14:44	2076	374	186	114	64	24	10	3	0	3	30.7	41
2/22/2010 14:45	2116	407	214	144	72	27	6	4	0	3	30.7	41
2/22/2010 14:46	2284	643	420	285	169	81	32	9	0	3	30.8	41
2/22/2010 14:47	2073	432	253	187	129	56	20	5	0	3	30.7	41
2/22/2010 14:48	2227	474	262	193	107	46	16	2	0	3	30.7	41
2/22/2010 14:49	2238	486	295	194	108	51	17	2	0	3	30.7	41
2/22/2010 14:50	2265	477	279	197	125	66	17	1	0	3	30.7	41
2/22/2010 14:51	2225	467	277	194	105	39	12	2	0	3	30.7	41
2/22/2010 14:52	2597	800	533	383	214	96	29	5	0	3	30.8	41
2/22/2010 14:53	2178	448	259	187	105	55	18	7	0	3	30.8	41
2/22/2010 14:54	2235	406	218	144	75	34	9	3	0	3	30.7	41
2/22/2010 14:55	2300	486	271	172	85	37	14	2	0	3	30.7	41
2/22/2010 14:56	2295	432	244	173	88	39	16	4	0	3	30.8	41
2/22/2010 14:57	2269	480	258	154	74	33	8	4	0	3	30.7	40
2/22/2010 14:58	2238	412	224	143	71	35	10	1	0	3	30.9	40
2/22/2010 14:59	2295	429	246	167	89	33	14	4	0	3	30.8	41
2/22/2010 15:00	2211	479	271	178	106	50	21	4	0	3	30.7	40
2/22/2010 15:01	2176	431	252	169	90	38	20	3	0	3	30.8	41
2/22/2010 15:02	2464	529	304	210	116	49	16	3	0	3	30.8	41
2/22/2010 15:03	2327	471	275	186	92	46	19	2	0	3	30.8	41
2/22/2010 15:04	2379	469	265	169	93	43	12	2	0	3	30.9	41
2/22/2010 15:05	2386	429	239	160	74	32	8	2	0	3	30.9	40
2/22/2010 15:06	2437	459	227	142	74	32	10	3	0	3	30.8	40
2/22/2010 15:07	2457	501	263	184	101	47	21	5	0	3	30.7	40

2/22/2010 15:08	2562	498	285	196	110	40	14	2	0	3	30.8	40
2/22/2010 15:09	3127	767	463	295	155	79	28	7	0	3	30.8	40
2/22/2010 15:10	3419	836	465	286	127	47	16	5	0	3	30.8	40
2/22/2010 15:11	3186	693	365	243	118	43	14	5	0	3	30.9	40
2/22/2010 15:12	3614	1064	610	389	188	78	24	4	0	3	30.9	40
2/22/2010 15:13	4184	1449	970	679	352	145	49	6	0	3	30.8	40
2/22/2010 15:14	3404	739	400	256	113	38	20	2	0	3	30.8	40
2/22/2010 15:15	3391	762	403	245	115	38	15	3	0	3	30.9	40
2/22/2010 15:16	3371	769	385	233	104	48	9	1	0	3	30.8	40
2/22/2010 15:17	3311	691	378	236	104	44	18	3	0	3	30.8	40
2/22/2010 15:18	4638	1865	1211	826	442	174	62	7	0	3	30.8	40
2/22/2010 15:19	3592	945	544	352	164	75	33	6	0	3	30.9	40
2/22/2010 15:20	3471	868	498	332	143	63	26	9	0	3	30.7	40
2/22/2010 15:21	3393	786	425	275	123	57	20	5	0	3	30.9	40
2/22/2010 15:22	3513	876	540	352	157	67	19	5	0	3	30.9	40
2/22/2010 15:23	3912	1104	685	454	204	74	22	3	0	3	30.9	41
2/22/2010 15:24	8568	4837	3386	2419	1229	528	194	51	0	3	30.8	40
2/22/2010 15:25	5798	2433	1526	962	412	145	42	5	0	3	30.8	40
2/22/2010 15:26	7545	3624	2246	1414	598	217	59	7	0	3	30.8	40
2/22/2010 15:27	16454	9667	5892	3538	1374	490	138	10	0	3	30.8	40
2/22/2010 15:28	5452	2218	1337	851	401	161	67	10	0	3	30.8	40
2/22/2010 15:29	4110	1300	751	477	204	83	23	6	0	3	30.8	41
2/22/2010 15:30	7635	3815	2471	1598	681	261	87	11	0	3	30.9	40
2/22/2010 15:31	3468	1010	599	381	161	47	13	5	0	3	30.8	40
2/22/2010 15:32	3247	807	454	296	136	38	11	2	0	3	30.7	40
2/22/2010 15:33	3144	788	453	309	143	48	13	4	0	3	30.7	40
2/22/2010 15:34	3127	770	434	262	113	43	16	3	0	3	30.8	40
2/22/2010 15:35	3231	786	432	275	125	50	11	2	0	3	30.8	40
2/22/2010 15:36	3197	694	378	223	101	30	11	1	0	3	30.7	40
2/22/2010 15:37	3162	752	376	227	105	43	12	2	0	3	30.7	40

2/22/2010 15:38	3762	1166	642	374	135	44	9	3	0	3	30.8	40
2/22/2010 15:39	4325	1448	841	473	169	59	17	1	0	3	30.6	40
2/22/2010 15:40	4371	1567	888	535	197	60	26	11	0	3	30.8	40
2/22/2010 15:41	4722	1744	1016	629	216	77	25	4	0	3	30.7	40

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/24/2010 13:29	1367	278	174	128	85	36	5	1	0	3	24.6	37
2/24/2010 13:30	2300	382	246	189	119	60	18	6	0	3	24.7	37
2/24/2010 13:31	2118	336	228	169	91	39	13	2	0	3	24.8	36
2/24/2010 13:32	2046	304	189	131	78	34	15	6	0	3	25	36
2/24/2010 13:33	1895	256	166	99	52	30	6	0	0	3	25.1	36
2/24/2010 13:34	1819	264	166	129	76	35	8	1	0	3	25.2	35
2/24/2010 13:35	2017	324	210	161	97	51	22	6	0	3	25.3	35
2/24/2010 13:36	1912	308	204	156	92	36	7	2	0	3	25.5	35
2/24/2010 13:37	1863	357	238	171	101	57	22	2	0	3	25.6	35
2/24/2010 13:38	1965	386	228	169	99	39	17	1	0	3	25.7	35
2/24/2010 13:39	2138	491	299	228	141	59	14	1	0	3	25.8	34
2/24/2010 13:40	2209	460	304	228	134	56	21	3	0	3	25.9	34
2/24/2010 13:41	2474	543	344	267	152	76	22	2	0	3	26.3	35
2/24/2010 13:42	2601	560	359	260	146	65	16	3	0	3	26.3	34
2/24/2010 13:43	2524	579	359	262	154	75	22	6	0	3	26.2	34
2/24/2010 13:44	2324	535	354	254	153	62	22	3	0	3	26.4	34
2/24/2010 13:45	2270	548	358	282	156	72	19	4	0	3	26.5	34
2/24/2010 13:46	2243	506	304	225	131	53	24	5	0	3	26.5	34
2/24/2010 13:47	2322	573	344	251	148	66	22	4	0	3	26.7	34

2/24/2010 13:48	2257	544	358	258	147	65	21	3	0	3	26.8	33
2/24/2010 13:49	2191	516	335	244	131	47	17	3	0	3	27	33
2/24/2010 13:50	2216	529	327	232	132	54	19	3	0	3	27	33
2/24/2010 13:51	2270	558	330	223	132	60	20	3	0	3	27.1	33
2/24/2010 13:52	2362	598	378	267	140	59	18	5	0	3	27.1	33
2/24/2010 13:53	2299	557	336	231	136	59	15	5	0	3	27.2	33
2/24/2010 13:54	2352	568	352	243	133	62	25	3	0	3	27.3	33
2/24/2010 13:55	2457	571	333	241	119	40	11	2	0	3	27.4	32
2/24/2010 13:56	2404	624	395	303	171	74	26	4	0	3	27.4	32
2/24/2010 13:57	2266	584	358	238	114	47	16	5	0	3	27.5	32
2/24/2010 13:58	2273	544	325	230	126	55	20	7	0	3	27.5	32
2/24/2010 13:59	2435	589	350	236	128	52	16	0	0	3	27.7	32
2/24/2010 14:00	2531	576	347	239	132	55	17	2	0	3	27.8	32
2/24/2010 14:01	2440	509	308	203	105	45	14	7	0	3	27.8	32
2/24/2010 14:02	2362	511	302	209	125	56	22	7	0	3	27.9	32
2/24/2010 14:03	2275	487	290	202	110	59	25	7	0	3	28.1	32
2/24/2010 14:04	2979	497	271	187	101	38	17	3	0	3	28.1	31
2/24/2010 14:05	2377	426	242	185	98	36	12	3	0	3	28.1	32
2/24/2010 14:06	2240	449	275	201	107	47	15	3	0	3	28.2	31
2/24/2010 14:07	2259	439	256	189	110	43	25	1	0	3	28.2	32
2/24/2010 14:08	2347	459	280	187	95	45	16	4	0	3	28.3	31
2/24/2010 14:09	2157	434	244	175	104	41	18	4	0	3	28.3	31
2/24/2010 14:10	2063	399	248	194	96	28	11	3	0	3	28.4	31
2/24/2010 14:11	2170	437	258	194	116	57	25	8	0	3	28.4	31
2/24/2010 14:12	2210	463	288	204	110	51	12	3	0	3	28.6	31
2/24/2010 14:13	2137	421	272	203	124	55	26	5	0	3	28.7	31
2/24/2010 14:14	2133	472	285	204	111	57	20	2	0	3	28.5	31

2/24/2010 14:15	2009	374	235	180	97	33	13	1	0	3	28.7	31
2/24/2010 14:16	1916	382	243	163	92	42	13	2	0	3	28.7	31
2/24/2010 14:17	1954	360	228	163	97	41	17	5	0	3	28.8	31
2/24/2010 14:18	2045	391	246	164	107	46	18	4	0	3	28.8	31
2/24/2010 14:19	1998	375	221	150	90	33	12	3	0	3	28.8	31
2/24/2010 14:20	1928	367	236	176	102	56	23	5	0	3	28.9	30
2/24/2010 14:21	1861	341	198	142	72	37	13	2	0	3	28.9	31
2/24/2010 14:22	1765	275	156	116	71	33	12	3	0	3	28.9	30
2/24/2010 14:23	1791	345	211	158	91	43	17	6	0	3	28.9	30
2/24/2010 14:24	1840	301	188	133	77	46	23	8	0	3	28.9	31
2/24/2010 14:25	1799	259	149	110	67	39	16	1	0	3	29.1	30
2/24/2010 14:26	1779	299	174	128	77	33	11	4	0	3	29.1	30
2/24/2010 14:27	1908	325	197	138	69	33	12	2	0	3	29.2	31
2/24/2010 14:28	1774	318	182	129	67	29	17	4	0	3	29.1	30
2/24/2010 14:29	1823	308	180	118	70	39	16	5	0	3	29.1	30
2/24/2010 14:30	1861	299	176	128	70	35	17	3	0	3	29.2	30
2/24/2010 14:31	2026	367	221	164	100	37	17	3	0	3	29.2	30
2/24/2010 14:32	1855	297	166	117	70	32	12	5	0	3	29.3	30
2/24/2010 14:33	1949	388	218	149	87	39	14	2	0	3	29.2	30
2/24/2010 14:34	2124	392	233	175	100	40	10	4	0	3	29.3	30
2/24/2010 14:35	2184	403	227	165	101	50	24	7	0	3	29.3	30
2/24/2010 14:36	2376	490	307	222	142	74	23	4	0	3	29.4	30
2/24/2010 14:37	2380	481	300	216	134	56	24	5	0	3	29.4	30
2/24/2010 14:38	2337	503	295	220	114	54	19	2	0	3	29.4	30
2/24/2010 14:39	2266	441	254	180	119	66	23	7	0	3	29.3	30
2/24/2010 14:40	2359	480	308	213	134	65	23	2	0	3	29.4	30
2/24/2010 14:41	2343	542	352	255	155	69	33	4	0	3	29.5	30

2/24/2010 14:42	2191	401	254	184	111	56	24	4	0	3	29.5	30
2/24/2010 14:43	2150	404	251	179	90	53	20	4	0	3	29.4	30
2/24/2010 14:44	2181	387	245	173	98	49	17	4	0	3	29.5	30
2/24/2010 14:45	2154	451	283	209	133	55	23	5	0	3	29.6	30
2/24/2010 14:46	2196	523	330	228	135	60	20	4	0	3	29.5	30
2/24/2010 14:47	2176	549	333	235	129	61	21	4	0	3	29.6	30
2/24/2010 14:48	2281	546	342	245	127	54	26	9	0	3	29.6	30
2/24/2010 14:49	2166	439	240	170	91	38	19	5	0	3	29.6	30
2/24/2010 14:50	2196	488	300	207	118	49	20	3	0	3	29.6	30
2/24/2010 14:51	2057	417	242	163	85	37	13	3	0	3	29.7	30
2/24/2010 14:52	2141	492	312	212	117	54	26	3	0	3	29.7	30
2/24/2010 14:53	2097	452	268	189	100	49	24	8	0	3	29.7	29
2/24/2010 14:54	2324	483	300	212	123	69	33	6	0	3	29.7	30
2/24/2010 14:55	2340	505	313	206	108	50	24	7	0	3	29.7	29
2/24/2010 14:56	2549	724	453	294	137	56	19	6	0	3	29.8	30
2/24/2010 14:57	2634	823	517	325	158	60	20	1	0	3	29.7	29
2/24/2010 14:58	2495	707	449	292	145	60	18	6	0	3	29.8	30
2/24/2010 14:59	2326	576	359	238	117	51	18	3	0	3	29.8	30
2/24/2010 15:00	2181	555	358	251	144	61	20	4	0	3	29.8	30
2/24/2010 15:01	2203	572	363	265	151	66	22	3	0	3	29.8	29
2/24/2010 15:02	2347	603	361	250	123	54	17	2	0	3	29.8	30
2/24/2010 15:03	2354	603	381	258	149	61	23	4	0	3	29.9	30
2/24/2010 15:04	4327	1772	1049	632	289	105	35	5	0	3	29.8	30
2/24/2010 15:05	5542	2614	1595	1004	445	145	35	7	0	3	29.8	30
2/24/2010 15:06	3789	1664	1126	735	344	123	37	3	0	3	29.8	30
2/24/2010 15:07	3405	1322	910	623	316	119	31	5	0	3	29.8	29
2/24/2010 15:08	2843	941	607	417	202	80	25	7	0	3	29.8	29

2/24/2010 15:09	4209	1642	969	606	302	138	58	19	0	3	29.8	30
2/24/2010 15:10	3181	1084	714	516	294	135	62	22	0	3	29.9	29
2/24/2010 15:11	2643	781	528	369	188	77	24	7	0	3	29.8	29
2/24/2010 15:12	3331	1172	752	510	270	113	40	12	0	3	29.9	30
2/24/2010 15:13	4504	2023	1314	857	400	150	38	7	0	3	29.8	30
2/24/2010 15:14	5033	2531	1729	1162	570	221	85	13	0	3	29.8	29
2/24/2010 15:15	4294	1978	1363	905	424	151	46	9	0	3	29.9	29
2/24/2010 15:16	3939	1748	1135	726	314	115	26	3	0	3	30.1	29
2/24/2010 15:17	3729	1614	1027	670	301	128	34	11	0	3	30	29
2/24/2010 15:18	3569	1418	923	587	276	119	33	6	0	3	29.9	29
2/24/2010 15:19	3762	1479	854	533	244	91	31	5	0	3	29.9	29
2/24/2010 15:20	4247	1706	1005	627	280	109	33	1	0	3	29.9	29
2/24/2010 15:21	4365	1586	897	554	221	79	17	2	0	3	30	29
2/24/2010 15:22	4656	1483	792	470	178	61	18	4	0	3	30	29
2/24/2010 15:23	5003	1650	899	525	229	82	28	6	0	3	29.9	29
2/24/2010 15:24	5472	1754	912	555	220	79	21	5	0	3	29.9	29
2/24/2010 15:25	5797	1772	914	534	220	92	34	7	0	3	30	29
2/24/2010 15:26	6605	2161	1073	640	251	82	20	7	0	3	30	29
2/24/2010 15:27	14348	7303	4312	2517	963	280	84	18	0	3	29.9	30
2/24/2010 15:28	9022	3750	2109	1309	555	176	51	6	0	3	29.9	29
2/24/2010 15:29	7553	2687	1486	925	381	120	25	2	0	3	30	29
2/24/2010 15:30	7308	2499	1332	830	318	117	41	6	0	3	30	29
2/24/2010 15:31	7585	2722	1543	985	453	161	48	14	0	3	30	30
2/24/2010 15:32	7238	2529	1402	898	398	141	46	12	0	3	29.9	29
2/24/2010 15:33	6786	2221	1231	804	328	122	42	7	0	3	30	29
2/24/2010 15:34	6825	2240	1206	760	324	117	43	5	0	3	29.9	29
2/24/2010 15:35	6391	2084	1129	702	328	118	39	8	0	3	30	29

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/25/2010 9:18	1477	291	142	93	45	25	8	3	0	3	6	66
2/25/2010 9:19	1491	313	144	89	38	19	4	1	0	3	6.5	66
2/25/2010 9:20	1436	303	142	91	44	17	8	3	0	3	7	63
2/25/2010 9:21	1426	274	141	72	33	15	7	4	0	3	7.6	61
2/25/2010 9:22	1407	311	161	107	46	24	10	4	0	3	8.2	59
2/25/2010 9:23	1483	311	148	90	41	22	7	1	0	3	8.8	56
2/25/2010 9:24	1592	381	209	133	66	37	15	2	0	3	9.5	54
2/25/2010 9:25	1464	307	145	88	39	15	6	2	0	3	9.9	53
2/25/2010 9:26	1562	312	161	87	43	25	7	0	0	3	10.6	50
2/25/2010 9:27	1650	358	178	102	44	13	3	1	0	3	11.2	48
2/25/2010 9:28	1528	324	167	100	43	21	6	1	0	3	11.8	47
2/25/2010 9:29	1594	330	171	110	53	22	4	0	0	3	12.4	46
2/25/2010 9:30	1594	312	145	75	34	8	0	0	0	3	13	44
2/25/2010 9:31	1557	307	138	78	36	15	9	3	0	3	13.6	43
2/25/2010 9:32	1612	348	177	105	44	20	8	1	0	3	14.1	42
2/25/2010 9:33	1496	286	131	90	46	23	4	1	0	3	14.6	41
2/25/2010 9:34	1484	305	138	80	38	18	7	4	0	3	15.1	40
2/25/2010 9:35	1408	258	111	70	30	12	5	2	0	3	15.6	40
2/25/2010 9:36	1588	319	136	87	44	20	3	0	0	3	16	39
2/25/2010 9:37	1585	337	133	84	36	20	5	3	0	3	16.4	38
2/25/2010 9:38	1752	373	174	93	40	18	6	2	0	3	16.7	37
2/25/2010 9:39	1793	350	148	84	43	19	7	4	0	3	17.2	37
2/25/2010 9:40	1749	386	172	108	55	22	8	1	0	3	17.4	37
2/25/2010 9:41	1886	387	162	94	46	25	9	3	0	3	17.8	36
2/25/2010 9:42	2017	402	172	97	45	16	6	1	0	3	18.1	36
2/25/2010 9:43	1973	437	180	101	48	24	7	2	0	3	18.5	35
2/25/2010 9:44	2010	420	205	132	65	31	10	3	0	3	18.7	35
2/25/2010 9:45	1905	442	211	143	79	39	17	5	0	3	19.1	36

2/25/2010 9:46	1934	544	295	194	106	46	24	7	0	3	19.3	34
2/25/2010 9:47	1978	477	254	173	101	48	15	5	0	3	19.6	34
2/25/2010 9:48	1771	394	191	128	63	26	11	2	0	3	19.9	33
2/25/2010 9:49	1814	432	228	146	84	37	13	4	0	3	20.1	33
2/25/2010 9:50	1710	378	186	121	62	28	10	4	0	3	20.4	32
2/25/2010 9:51	1664	383	203	132	76	31	6	1	0	3	20.6	32
2/25/2010 9:52	1722	505	288	204	125	67	27	4	0	3	20.9	32
2/25/2010 9:53	1638	437	256	181	101	50	16	4	0	3	21.1	31
2/25/2010 9:54	1522	400	239	169	86	40	14	4	0	3	21.3	31
2/25/2010 9:55	1459	424	230	166	98	36	10	1	0	3	21.5	31
2/25/2010 9:56	1464	404	235	159	90	38	12	0	0	3	21.7	32
2/25/2010 9:57	1892	592	351	219	101	38	15	2	0	3	21.8	32
2/25/2010 9:58	2851	1238	742	467	216	79	21	5	0	3	22.1	31
2/25/2010 9:59	1438	404	225	161	74	41	16	4	0	3	22.3	30
2/25/2010 10:00	1457	422	240	164	77	41	15	2	0	3	22.4	30
2/25/2010 10:01	1672	568	350	233	133	66	21	6	0	3	22.5	30
2/25/2010 10:02	2257	980	640	459	219	80	22	3	0	3	22.7	30
2/25/2010 10:03	2261	1014	668	454	222	95	29	5	0	3	22.8	29
2/25/2010 10:04	1929	807	538	370	181	77	28	4	0	3	23.1	29
2/25/2010 10:05	1814	755	481	355	186	66	18	5	0	3	23.3	29
2/25/2010 10:06	1567	591	406	303	165	72	21	5	0	3	23.3	29
2/25/2010 10:07	1375	520	355	259	139	62	16	2	0	3	23.5	29
2/25/2010 10:08	1209	413	280	207	114	50	9	2	0	3	23.7	29
2/25/2010 10:09	1217	399	269	199	124	47	14	3	0	3	23.8	28
2/25/2010 10:10	1202	373	250	178	93	43	14	2	0	3	23.9	28
2/25/2010 10:11	1107	358	230	168	95	45	11	2	0	3	24.2	28
2/25/2010 10:12	1154	394	252	182	94	42	17	4	0	3	23.9	28
2/25/2010 10:13	1080	352	223	162	88	45	14	1	0	3	24.2	28
2/25/2010 10:14	1134	376	244	180	100	43	18	2	0	3	24.4	27
2/25/2010 10:15	1379	520	328	231	129	54	24	1	0	3	24.5	28

2/25/2010 10:16	1196	464	313	220	128	53	19	5	0	3	24.6	27
2/25/2010 10:17	1291	528	351	267	145	60	16	4	0	3	24.7	27
2/25/2010 10:18	1161	429	297	211	117	32	15	2	0	3	24.7	27
2/25/2010 10:19	1040	380	258	185	109	41	13	2	0	3	24.9	27
2/25/2010 10:20	956	351	239	185	105	45	11	3	0	3	24.9	27
2/25/2010 10:21	965	311	219	153	87	40	13	3	0	3	25.1	27
2/25/2010 10:22	1015	377	271	198	112	46	15	2	0	3	25.2	27
2/25/2010 10:23	935	315	216	155	86	29	9	3	0	3	25.3	26
2/25/2010 10:24	984	334	237	183	94	42	13	2	0	3	25.3	27
2/25/2010 10:25	873	327	236	171	97	44	12	2	0	3	25.4	26
2/25/2010 10:26	988	374	272	199	115	50	15	4	0	3	25.5	26
2/25/2010 10:27	982	375	270	199	112	56	20	6	0	3	25.6	26
2/25/2010 10:28	930	326	227	171	103	45	15	4	0	3	25.6	26
2/25/2010 10:29	1020	405	289	223	126	58	18	3	0	3	25.7	26
2/25/2010 10:30	930	392	281	220	117	52	18	3	0	3	25.8	26
2/25/2010 10:31	977	394	283	213	128	61	21	8	0	3	25.9	26
2/25/2010 10:32	1075	465	328	245	159	60	20	0	0	3	26	26
2/25/2010 10:33	2800	1189	630	346	148	67	18	2	0	3	26.1	26
2/25/2010 10:34	1336	549	359	247	135	66	24	5	0	3	26.2	26
2/25/2010 10:35	1250	526	348	255	141	62	21	8	0	3	26.1	25
2/25/2010 10:36	1171	499	339	255	145	51	13	2	0	3	26.3	26
2/25/2010 10:37	1046	396	252	192	97	40	13	3	0	3	26.3	25
2/25/2010 10:38	992	370	252	192	107	41	18	2	0	3	26.3	25
2/25/2010 10:39	965	339	228	173	92	40	11	2	0	3	26.5	25
2/25/2010 10:40	910	306	216	164	87	37	16	5	0	3	26.5	26
2/25/2010 10:41	1005	392	269	208	111	54	21	3	0	3	26.5	25
2/25/2010 10:42	984	402	291	237	145	73	24	4	0	3	26.6	25
2/25/2010 10:43	985	362	274	216	123	65	22	3	0	3	26.5	25
2/25/2010 10:44	981	416	310	222	123	50	18	2	0	3	26.7	25
2/25/2010 10:45	888	312	227	177	105	46	14	0	0	3	26.8	25

2/25/2010 10:46	949	359	240	187	110	55	23	0	0	3	26.8	25
2/25/2010 10:47	931	353	256	194	108	50	17	2	0	3	26.9	25
2/25/2010 10:48	1454	692	488	354	186	63	24	2	0	3	26.9	25
2/25/2010 10:49	1835	987	674	487	244	101	26	8	0	3	26.9	25
2/25/2010 10:50	1563	792	576	412	223	81	28	2	0	3	27	25
2/25/2010 10:51	1799	937	655	469	256	116	36	8	0	3	27	25
2/25/2010 10:52	1767	900	599	409	213	78	26	3	0	3	27	25
2/25/2010 10:53	6076	3312	2005	1306	611	225	70	15	0	3	27	25
2/25/2010 10:54	1578	712	468	331	150	67	14	2	0	3	27.2	25
2/25/2010 10:55	1460	642	441	308	143	56	17	1	0	3	27.2	25
2/25/2010 10:56	1375	576	390	276	143	61	20	5	0	3	27.2	25
2/25/2010 10:57	1385	575	395	269	148	61	21	2	0	3	27.3	25
2/25/2010 10:58	1486	750	543	404	225	102	28	7	0	3	27.4	25
2/25/2010 10:59	1356	577	417	315	166	77	20	3	0	3	27.4	24
2/25/2010 11:00	1293	532	344	241	139	61	17	4	0	3	27.3	24
2/25/2010 11:01	2125	1015	634	425	234	89	34	5	0	3	27.4	25
2/25/2010 11:02	1429	572	415	296	159	64	21	4	0	3	27.4	24
2/25/2010 11:03	1338	508	345	271	155	81	26	4	0	3	27.6	24
2/25/2010 11:04	1244	466	315	228	135	60	19	4	0	3	27.5	24
2/25/2010 11:05	1254	442	305	212	118	52	14	5	0	3	27.6	24
2/25/2010 11:06	1376	545	396	307	187	83	34	11	0	3	27.6	25
2/25/2010 11:07	1609	651	431	312	181	83	28	7	0	3	27.5	25
2/25/2010 11:08	1486	521	339	258	160	71	22	4	0	3	27.6	25
2/25/2010 11:09	1500	537	375	291	175	73	23	3	0	3	27.7	24
2/25/2010 11:10	1582	462	321	231	136	68	22	0	0	3	27.6	24
2/25/2010 11:11	1500	445	282	209	131	61	24	5	0	3	27.7	24
2/25/2010 11:12	1624	557	369	282	172	83	28	5	0	3	27.8	24
2/25/2010 11:14	1743	600	413	307	200	95	34	8	0	3	27.7	25
2/25/2010 11:15	9944	5708	3420	2027	790	243	60	11	0	3	27.8	24
2/25/2010 11:16	15902	9417	5492	3187	1126	320	70	8	0	3	27.8	25

2/25/2010 11:17	7176	3859	2287	1410	544	189	49	8	0	3	27.8	24
2/25/2010 11:18	2190	846	532	356	170	68	26	3	0	3	27.8	25
2/25/2010 11:18	1628	546	312	204	106	52	18	3	0	3	27.8	24
2/25/2010 11:20	1395	403	244	189	109	48	18	2	0	3	27.8	24
2/25/2010 11:21	1446	449	313	225	135	54	23	6	0	3	27.9	24
2/25/2010 11:22	1518	518	347	252	143	69	21	5	0	3	27.9	24
2/25/2010 11:23	1466	515	371	268	176	84	29	4	0	3	27.9	24
2/25/2010 11:24	4683	2643	1684	1063	423	147	51	8	0	3	27.9	24
2/25/2010 11:25	2180	955	606	412	178	66	27	3	0	3	27.9	24
2/25/2010 11:26	1682	659	447	316	174	60	18	3	0	3	27.8	24
2/25/2010 11:27	1502	544	351	255	137	58	17	2	0	3	28	24

Time	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
2/25/2010 13:01	7240	3861	2185	1343	588	231	82	23	0	3	28.2	24
2/25/2010 13:02	1680	536	308	193	95	45	17	4	0	3	28.1	23
2/25/2010 13:03	1452	415	250	155	76	35	13	6	0	3	28.1	23
2/25/2010 13:04	1349	400	231	157	92	36	10	2	0	3	28.2	23
2/25/2010 13:05	1445	418	254	182	96	44	20	10	0	3	28.2	23
2/25/2010 13:06	1284	354	227	154	84	41	20	8	0	3	28.2	23
2/25/2010 13:07	1228	314	205	146	81	36	18	7	0	3	28.1	23
2/25/2010 13:08	1259	346	212	140	81	40	16	8	0	3	28.2	23
2/25/2010 13:09	1276	303	184	131	85	43	18	7	0	3	28.1	23
2/25/2010 13:10	1360	354	199	145	84	36	13	6	0	3	28.1	23
2/25/2010 13:11	1364	386	248	178	113	60	27	12	0	3	28	24
2/25/2010 13:12	1342	383	260	204	127	58	28	11	0	3	28.2	24
2/25/2010 13:13	1218	292	191	132	74	37	17	5	0	3	28.2	23

2/25/2010 13:14	1304	386	268	204	111	54	12	4	0	3	28.2	24
2/25/2010 13:15	1268	442	321	231	150	68	27	5	0	3	28.1	24
2/25/2010 13:16	1198	344	230	168	106	51	24	5	0	3	28.2	24
2/25/2010 13:17	1284	401	279	213	125	52	30	8	0	3	28.1	24
2/25/2010 13:18	1139	338	200	149	94	47	20	2	0	3	28.2	23
2/25/2010 13:19	1118	309	196	140	81	31	13	6	0	3	28.2	24
2/25/2010 13:20	1191	387	277	216	141	80	32	10	0	3	28.2	24
2/25/2010 13:21	1144	301	195	149	93	42	19	6	0	3	28.1	24
2/25/2010 13:22	1115	288	197	144	86	45	24	13	0	3	28.1	24
2/25/2010 13:23	1207	429	301	220	130	57	19	8	0	3	28.2	24
2/25/2010 13:24	1074	291	197	154	87	39	17	5	0	3	28.2	23
2/25/2010 13:25	1017	268	183	141	86	48	19	3	0	3	28.2	23
2/25/2010 13:26	1052	296	206	161	102	51	28	6	0	3	28.1	24
2/25/2010 13:27	1048	263	183	138	83	49	19	5	0	3	28.2	24
2/25/2010 13:28	1026	274	189	146	76	35	7	2	0	3	28.2	24
2/25/2010 13:29	1106	322	219	147	85	45	19	7	0	3	28.3	23
2/25/2010 13:30	1033	292	199	155	95	46	13	1	0	3	28.3	23
2/25/2010 13:31	1023	259	172	124	75	34	10	1	0	3	28.2	23
2/25/2010 13:32	1003	237	160	124	73	38	15	7	0	3	28.2	23
2/25/2010 13:33	1043	246	167	128	81	44	14	4	0	3	28.2	24
2/25/2010 13:34	1012	253	172	132	77	28	9	1	0	3	28.3	24
2/25/2010 13:35	1073	238	168	117	75	36	17	3	0	3	28.2	23
2/25/2010 13:36	1043	239	169	125	81	34	14	2	0	3	28.3	23
2/25/2010 13:37	1361	474	309	231	139	61	27	8	0	3	28.3	24
2/25/2010 13:38	1171	330	221	163	98	43	20	7	0	3	28.3	24
2/25/2010 13:39	1146	245	176	129	79	42	15	4	0	3	28.3	24
2/25/2010 13:40	1132	217	145	103	62	31	12	4	0	3	28.3	23
2/25/2010 13:41	1096	202	130	98	58	23	8	2	0	3	28.3	23
2/25/2010 13:42	1193	221	143	110	71	36	17	3	0	3	28.2	23
2/25/2010 13:43	1129	211	127	91	57	27	8	2	0	3	28.3	24

2/25/2010 13:44	1111	227	140	97	57	33	14	3	0	3	28.4	24
2/25/2010 13:45	1311	342	218	157	93	52	22	3	0	3	28.3	24
2/25/2010 13:46	1786	667	471	348	210	107	42	0	0	3	28.3	24
2/25/2010 13:47	1273	242	134	92	56	28	12	4	0	3	28.4	23
2/25/2010 13:48	1475	325	207	154	86	40	15	3	0	3	28.5	24
2/25/2010 13:49	1537	335	211	150	84	37	13	3	0	3	28.4	23
2/25/2010 13:50	1487	329	179	128	82	43	19	6	0	3	28.4	23
2/25/2010 13:51	1429	248	146	95	54	22	13	3	0	3	28.4	23
2/25/2010 13:52	1391	218	133	101	51	17	11	2	0	3	28.4	24
2/25/2010 13:53	1362	191	110	88	50	27	8	1	0	3	28.5	23
2/25/2010 13:54	1403	219	131	99	63	29	8	1	0	3	28.3	23
2/25/2010 13:55	1334	258	135	90	67	32	9	4	0	3	28.4	24
2/25/2010 13:56	1278	234	127	94	55	27	7	0	0	3	28.5	23
2/25/2010 13:57	1171	201	114	84	53	26	13	3	0	3	28.4	24
2/25/2010 13:58	1228	203	135	100	66	32	10	3	0	3	28.4	23
2/25/2010 13:59	1177	180	112	72	50	26	7	3	0	3	28.5	23
2/25/2010 14:00	1178	174	93	60	34	20	10	1	0	3	28.4	23
2/25/2010 14:01	1112	144	83	54	34	16	7	1	0	3	28.4	23
2/25/2010 14:02	1115	162	91	67	42	15	9	4	0	3	28.5	23
2/25/2010 14:03	1182	215	146	111	64	32	17	1	0	3	28.4	23
2/25/2010 14:04	1174	198	102	69	39	25	12	2	0	3	28.5	23
2/25/2010 14:05	1204	222	127	97	56	29	10	3	0	3	28.5	23
2/25/2010 14:06	1198	223	140	105	58	26	14	5	0	3	28.5	23
2/25/2010 14:07	1193	236	143	101	62	33	16	4	0	3	28.4	23
2/25/2010 14:08	1156	216	135	96	58	33	9	2	0	3	28.5	23
2/25/2010 14:09	1144	201	114	84	49	22	10	3	0	3	28.5	23
2/25/2010 14:10	1118	198	109	86	43	20	7	1	0	3	28.6	24
2/25/2010 14:11	1129	228	115	82	40	18	6	0	0	3	28.6	23
2/25/2010 14:12	1241	264	143	100	43	23	7	1	0	3	28.6	23
2/25/2010 14:13	1400	311	170	110	63	28	12	1	0	3	28.5	23

2/25/2010 14:14	1293	275	159	122	71	28	6	1	0	3	28.5	23
2/25/2010 14:15	1319	334	217	160	94	37	8	3	0	3	28.6	23
2/25/2010 14:16	1360	385	254	191	110	50	24	6	0	3	28.6	23
2/25/2010 14:17	1936	766	488	351	182	77	30	4	0	3	28.7	24
2/25/2010 14:18	1561	500	325	243	143	78	32	4	0	3	28.7	24
2/25/2010 14:19	2587	1052	632	418	209	103	35	9	0	3	28.6	24
2/25/2010 14:20	1492	558	356	236	122	57	22	3	0	3	28.5	24
2/25/2010 14:21	1427	477	337	244	138	63	27	7	0	3	28.6	24
2/25/2010 14:22	1337	433	295	207	126	51	23	6	0	3	28.6	23
2/25/2010 14:23	1288	392	250	189	90	36	15	2	0	3	28.6	23
2/25/2010 14:24	1146	318	207	151	73	37	15	3	0	3	28.7	23
2/25/2010 14:25	1104	304	205	149	94	41	11	2	0	3	28.6	23
2/25/2010 14:26	1078	262	182	136	83	47	23	3	0	3	28.7	23
2/25/2010 14:27	1006	290	196	141	90	49	21	5	0	3	28.7	23
2/25/2010 14:28	1115	350	214	157	82	40	15	4	0	3	28.6	23
2/25/2010 14:29	1159	324	199	142	87	39	14	5	0	3	28.7	24
2/25/2010 14:30	1260	343	219	157	89	48	21	5	0	3	28.7	24
2/25/2010 14:31	1813	695	410	290	152	61	20	7	0	3	28.7	24
2/25/2010 14:32	1289	458	285	221	138	73	25	5	0	3	28.7	24
2/25/2010 14:33	1315	400	245	170	112	55	24	5	0	3	28.8	24
2/25/2010 14:34	1226	372	225	165	105	51	19	6	0	3	28.7	23
2/25/2010 14:35	1208	368	223	167	99	48	19	2	0	3	28.6	24
2/25/2010 14:36	1157	351	219	164	100	47	16	2	0	3	28.7	23
2/25/2010 14:37	1164	353	208	141	90	44	15	5	0	3	28.8	23
2/25/2010 14:38	1271	379	227	166	98	52	26	3	0	3	28.7	23
2/25/2010 14:39	1171	372	240	190	119	50	21	6	0	3	28.7	23
2/25/2010 14:40	1037	295	181	128	82	46	20	2	0	3	28.6	24
2/25/2010 14:41	1161	368	246	179	112	51	23	6	0	3	28.7	24
2/25/2010 14:42	1160	367	220	173	96	46	20	7	0	3	28.7	24
2/25/2010 14:43	1143	394	241	172	98	49	17	3	0	3	28.7	23

2/25/2010 14:44	1013	307	203	152	88	42	17	5	0	3	28.7	23
2/25/2010 14:45	1044	315	207	157	100	43	21	4	0	3	28.8	23
2/25/2010 14:46	1141	376	253	193	110	49	16	3	0	3	28.7	23
2/25/2010 14:47	1247	495	370	285	183	94	41	11	0	3	28.8	23
2/25/2010 14:48	1595	713	508	394	227	120	37	8	0	3	28.8	23
2/25/2010 14:49	1244	426	292	215	131	71	22	7	0	3	28.8	23
2/25/2010 14:50	1151	385	264	198	131	62	17	6	0	3	28.8	23
2/25/2010 14:51	1143	389	273	193	111	56	24	4	0	3	28.7	23
2/25/2010 14:52	1075	300	217	172	112	46	16	7	0	3	28.8	23
2/25/2010 14:53	1192	392	289	231	141	80	29	5	0	3	28.7	23
2/25/2010 14:54	1127	373	254	199	132	59	29	9	0	3	28.7	23
2/25/2010 14:55	1106	327	230	171	107	42	13	4	0	3	28.8	23
2/25/2010 14:56	1081	313	191	149	93	39	14	3	0	3	28.7	23
2/25/2010 14:57	1030	257	191	138	82	38	17	5	0	3	28.7	23
2/25/2010 14:58	1131	354	254	198	120	58	17	4	0	3	28.8	23
2/25/2010 14:59	1023	309	220	174	101	44	16	3	0	3	28.8	23
2/25/2010 15:00	948	274	191	149	99	48	14	1	0	3	28.7	23
2/25/2010 15:01	931	268	190	142	88	34	9	3	0	3	28.8	23
2/25/2010 15:02	1148	390	272	198	114	54	19	4	0	3	29	23
2/25/2010 15:03	1089	417	289	228	136	58	22	3	0	3	28.9	23
2/25/2010 15:04	1207	414	295	222	136	66	27	3	0	3	28.9	23
2/25/2010 15:05	1160	373	266	189	115	55	15	4	0	3	28.9	23
2/25/2010 15:06	1164	434	283	214	128	59	19	3	0	3	28.8	23
2/25/2010 15:07	1190	461	330	263	162	76	26	5	0	3	28.8	23
2/25/2010 15:08	1292	544	367	293	160	73	28	3	0	3	28.8	23
2/25/2010 15:09	1589	692	493	334	172	63	16	2	0	3	28.8	23
2/25/2010 15:10	2265	1212	839	580	319	130	46	3	0	3	28.8	23
2/25/2010 15:11	1764	853	618	441	248	105	30	2	0	3	28.9	23
2/25/2010 15:12	1502	676	474	335	195	92	30	10	0	3	28.7	23
2/25/2010 15:13	1380	535	359	262	143	56	20	3	0	3	28.9	23

2/25/2010 15:14	1272	481	341	256	145	64	22	3	0	3	28.8	23
2/25/2010 15:15	1188	423	290	216	121	51	21	4	0	3	28.8	23
2/25/2010 15:16	1082	406	271	188	96	41	5	1	0	3	28.9	23
2/25/2010 15:17	1076	374	242	186	114	51	11	4	0	3	28.9	23
2/25/2010 15:18	1035	358	229	169	100	43	21	5	0	3	28.8	23
2/25/2010 15:19	1077	397	257	171	96	41	10	3	0	3	28.9	23
2/25/2010 15:20	1047	356	233	185	88	33	8	1	0	3	28.8	23
2/25/2010 15:21	1037	395	294	225	144	54	23	5	0	3	28.8	23
2/25/2010 15:22	1062	366	244	178	105	43	16	2	0	3	28.9	23
2/25/2010 15:23	1239	522	379	279	155	80	27	5	0	3	28.9	23
2/25/2010 15:24	1248	563	418	319	166	68	12	3	0	3	28.9	23
2/25/2010 15:25	1402	625	457	355	201	100	33	4	0	3	28.9	23
2/25/2010 15:26	1621	840	619	464	276	118	37	13	0	3	28.9	23
2/25/2010 15:27	1701	800	561	412	229	97	39	6	0	3	28.9	23
2/25/2010 15:28	1477	696	477	355	195	92	25	7	0	3	28.9	23
2/25/2010 15:29	1322	584	416	302	178	84	25	2	0	3	28.9	23
2/25/2010 15:30	1334	615	449	344	197	75	17	1	0	3	28.9	23
2/25/2010 15:31	1277	510	371	272	166	75	22	2	0	3	28.9	23
2/25/2010 15:32	1454	597	408	301	175	67	26	6	0	3	28.9	23
2/25/2010 15:33	1433	589	432	314	154	68	15	4	0	3	28.8	23
2/25/2010 15:34	1291	521	359	256	131	64	26	6	0	3	28.9	23
2/25/2010 15:35	1383	626	432	310	168	71	24	2	0	3	28.9	23
2/25/2010 15:36	1310	540	381	286	151	72	24	4	0	3	28.9	23
2/25/2010 15:37	1374	574	409	299	158	61	19	2	0	3	28.9	23
2/25/2010 15:38	1438	589	417	302	188	78	28	3	0	3	28.9	23
2/25/2010 15:39	2000	985	687	498	279	106	36	8	0	3	28.9	23
2/25/2010 15:40	1949	972	686	503	293	127	36	6	0	3	28.9	23
2/25/2010 15:41	1839	965	648	471	240	91	34	8	0	3	28.8	23
2/25/2010 15:42	1952	989	685	481	281	116	32	3	0	3	28.9	23
2/25/2010 15:43	3116	1558	975	640	328	125	42	7	0	3	28.9	23

2/25/2010 15:44	2245	1158	751	486	230	96	26	4	0	3	28.9	23
2/25/2010 15:45	2609	1382	890	646	325	129	33	7	0	3	28.9	23
2/25/2010 15:46	2558	1316	843	552	265	94	30	7	0	3	28.8	23
2/25/2010 15:47	2392	1180	723	473	214	84	36	7	0	3	28.8	23
2/25/2010 15:48	2346	1164	728	462	219	93	19	2	0	3	28.9	23
2/25/2010 15:49	2600	1246	789	521	221	80	26	7	0	3	28.9	23
2/25/2010 15:50	2976	1518	965	625	310	110	31	5	0	3	28.9	23
2/25/2010 15:51	2952	1536	1030	716	357	140	37	7	0	3	28.9	23
2/25/2010 15:52	2871	1413	898	595	272	88	34	7	0	3	28.9	23
2/25/2010 15:53	2957	1442	908	605	256	105	39	5	0	3	28.8	23
2/25/2010 15:54	2952	1432	885	572	281	105	25	5	0	3	28.9	23
2/25/2010 15:55	3182	1566	981	677	327	122	48	12	0	3	28.9	23
2/25/2010 15:56	2679	1302	815	532	239	86	30	4	0	3	29	23
2/25/2010 15:57	2509	1192	761	528	263	98	29	4	0	3	28.9	23
2/25/2010 15:58	2280	996	648	446	239	96	29	6	0	3	28.9	23
2/25/2010 15:59	2283	995	646	437	229	94	34	4	0	3	28.9	23
2/25/2010 16:00	2308	987	613	439	220	83	26	5	0	3	28.9	23
2/25/2010 16:01	2217	935	621	421	209	80	28	4	0	3	29	23
2/25/2010 16:02	2172	926	599	412	210	88	33	4	0	3	28.9	23
2/25/2010 16:03	2301	1021	637	449	227	80	27	9	0	3	28.8	23
2/25/2010 16:04	2235	989	634	455	247	109	44	8	0	3	28.9	23
2/25/2010 16:05	4650	2790	2029	1465	769	320	95	22	0	3	28.9	23
2/25/2010 16:06	4979	2979	2078	1400	659	250	76	9	0	3	28.9	23
2/25/2010 16:07	4262	2407	1597	1041	465	161	47	8	0	3	28.9	23
2/25/2010 16:08	3729	1988	1316	861	394	138	40	6	0	3	28.9	23
2/25/2010 16:09	2736	1362	911	631	307	95	22	1	0	3	29	23
2/25/2010 16:10	2477	1187	797	569	269	105	37	12	0	3	28.8	23
2/25/2010 16:11	2313	980	639	419	208	71	20	3	0	3	28.9	23
2/25/2010 16:12	2591	1163	767	519	243	91	21	6	0	3	29	23
2/25/2010 16:13	3170	1502	922	590	269	82	27	7	0	3	28.8	23

2/25/2010 16:14	3241	1517	940	604	288	118	35	9	0	3	28.8	23
2/25/2010 16:15	4395	2312	1543	1042	484	194	51	8	0	3	28.9	23
2/25/2010 16:16	4735	2435	1622	1097	528	196	63	6	0	3	28.9	23
2/25/2010 16:17	4134	2067	1315	899	419	151	41	2	0	3	28.8	23
2/25/2010 16:18	3661	1759	1147	751	364	136	38	2	0	3	28.9	23
2/25/2010 16:19	3263	1411	892	618	305	115	32	5	0	3	28.8	23
2/25/2010 16:20	3013	1330	874	611	311	130	36	8	0	3	28.8	23
2/25/2010 16:21	2764	1225	815	572	305	130	37	8	0	3	28.7	23
2/25/2010 16:22	2579	1175	790	569	315	133	44	6	0	3	28.8	23
2/25/2010 16:23	2635	1163	797	599	342	134	46	11	0	3	28.9	23
2/25/2010 16:24	3468	1816	1273	899	514	223	75	8	0	3	28.8	23
2/25/2010 16:25	14031	8580	5359	3305	1357	489	130	8	0	3	28.8	23
2/25/2010 16:26	4974	2683	1698	1124	547	206	64	10	0	3	28.9	23
2/25/2010 16:27	2941	1417	920	664	344	120	45	6	0	3	28.9	23
2/25/2010 16:28	2497	1077	743	523	287	118	34	8	0	3	28.8	23
2/25/2010 16:29	2619	1197	835	607	338	156	53	15	0	3	28.8	23

Time	**Particle Count**								**Alarms**	**Flow(lpm)**	**AT(C)**	**RH(%)**
	0.3 µm	**0.5 µm**	**0.7 µm**	**1.0 µm**	**2.0 µm**	**3.0 µm**	**5 µm**	**10.0 µm**				
3/3/2010 9:16	1735	258	137	90	50	18	10	2	0	2.8	13.1	51
3/3/2010 9:17	1915	296	175	124	79	34	15	5	0	3	13.7	49
3/3/2010 9:18	1995	300	174	129	73	44	18	2	0	3	14.4	47
3/3/2010 9:19	2043	262	157	112	60	24	9	2	0	3	14.8	46
3/3/2010 9:20	2088	271	149	109	65	29	11	6	0	3	15.4	45
3/3/2010 9:21	2031	250	140	91	50	24	9	4	0	3	15.9	44
3/3/2010 9:22	2104	223	125	95	54	30	7	3	0	3	16.5	43
3/3/2010 9:23	2075	202	127	87	45	16	6	0	0	3	17.1	42

3/3/2010 9:24	2011	202	109	76	37	17	6	3	0	3	17.5	42
3/3/2010 9:25	1998	209	122	86	50	22	7	2	0	3	17.9	41
3/3/2010 9:26	1973	246	147	102	49	24	13	5	0	3	18.3	40
3/3/2010 9:27	2033	180	96	74	37	15	9	1	0	3	18.6	40
3/3/2010 9:28	2027	181	100	63	35	15	6	1	0	3	19.1	39
3/3/2010 9:29	1905	191	110	66	45	20	6	2	0	3	19.6	38
3/3/2010 9:30	1922	178	103	74	43	19	12	4	0	3	19.9	38
3/3/2010 9:31	1863	155	84	58	29	15	4	1	0	3	20.1	38
3/3/2010 9:32	1858	157	79	54	35	15	6	3	0	3	20.5	37
3/3/2010 9:33	1802	148	86	63	34	13	7	1	0	3	20.8	37
3/3/2010 9:34	1833	164	81	59	35	12	5	2	0	3	21	36
3/3/2010 9:35	1746	136	76	52	32	17	5	1	0	3	21.3	36
3/3/2010 9:36	1823	136	71	45	25	13	5	0	0	3	21.5	35
3/3/2010 9:37	1801	127	60	44	23	8	3	0	0	3	21.7	35
3/3/2010 9:38	1749	133	75	47	26	13	7	1	0	3	22	35
3/3/2010 9:39	1673	124	52	42	25	15	9	3	0	3	22.2	35
3/3/2010 9:40	1771	136	71	52	28	16	6	2	0	3	22.5	34
3/3/2010 9:41	1692	122	60	39	22	11	3	2	0	3	22.6	34
3/3/2010 9:42	1665	108	70	48	25	9	4	0	0	3	22.9	34
3/3/2010 9:43	1627	96	44	31	21	10	3	1	0	3	22.9	33
3/3/2010 9:44	1677	136	71	40	21	9	4	1	0	3	23.2	33
3/3/2010 9:45	1630	130	67	42	24	9	0	0	0	3	23.3	33
3/3/2010 9:46	1713	143	74	53	30	14	6	0	0	3	23.5	33
3/3/2010 9:47	1781	174	105	76	44	24	12	1	0	3	23.7	33
3/3/2010 9:48	1868	165	84	58	28	14	3	1	0	3	23.8	33
3/3/2010 9:49	1815	136	83	60	36	20	5	2	0	3	24	32
3/3/2010 9:50	1865	157	83	60	28	14	6	1	0	3	24.2	32
3/3/2010 9:51	1945	179	95	63	36	25	5	1	0	3	24.2	32
3/3/2010 9:52	1890	191	104	62	36	13	6	2	0	3	24.3	32
3/3/2010 9:53	1904	204	117	80	40	20	5	1	0	3	24.5	31

3/3/2010 9:54	1985	226	113	75	36	17	6	2	0	3	24.7	32
3/3/2010 9:55	2123	267	132	84	38	17	9	4	0	3	24.7	31
3/3/2010 9:56	2110	225	129	89	43	21	10	2	0	3	24.9	31
3/3/2010 9:57	2032	264	152	97	51	17	5	2	0	3	25	31
3/3/2010 9:58	2133	246	149	104	63	30	15	6	0	3	25.1	31
3/3/2010 9:59	1975	242	126	79	46	26	9	0	0	3	25.2	31
3/3/2010 10:00	1973	240	128	94	59	36	20	8	0	3	25.3	31
3/3/2010 10:01	1894	224	117	82	44	28	9	4	0	3	25.5	30
3/3/2010 10:02	2011	203	111	72	44	20	9	1	0	3	25.6	30
3/3/2010 10:03	2046	251	155	111	67	32	13	6	0	3	25.6	30
3/3/2010 10:04	1963	240	150	102	66	25	10	4	0	3	25.7	30
3/3/2010 10:05	1959	221	125	87	57	23	11	1	0	3	25.8	30
3/3/2010 10:06	1944	217	126	90	54	33	15	3	0	3	25.9	30
3/3/2010 10:07	1956	229	122	77	35	15	9	4	0	3	25.9	30
3/3/2010 10:08	1969	226	131	99	63	34	18	5	0	3	26	30
3/3/2010 10:09	1928	211	130	98	49	19	5	1	0	3	26.1	30
3/3/2010 10:10	1880	207	125	95	62	34	11	0	0	3	26.1	30
3/3/2010 10:11	1978	268	168	121	83	47	21	6	0	3	26.3	30
3/3/2010 10:12	1912	237	143	93	53	20	7	3	0	3	26.3	30
3/3/2010 10:13	2039	247	139	104	62	29	10	3	0	3	26.3	30
3/3/2010 10:14	1993	268	160	127	79	39	18	8	0	3	26.4	30
3/3/2010 10:15	1946	266	159	123	75	44	16	4	0	3	26.6	29
3/3/2010 10:16	2020	265	155	102	61	27	10	3	0	3	26.6	30
3/3/2010 10:17	2046	251	138	90	45	16	5	1	0	3	26.5	30
3/3/2010 10:18	2124	293	169	123	76	33	13	5	0	3	26.6	29
3/3/2010 10:19	2141	308	162	115	68	36	16	5	0	3	26.7	29
3/3/2010 10:20	2091	273	164	120	64	32	15	6	0	3	26.8	29
3/3/2010 10:21	2201	316	171	120	74	40	21	5	0	3	26.8	29
3/3/2010 10:22	2346	344	165	111	61	30	16	2	0	3	26.9	29
3/3/2010 10:23	2377	318	166	108	58	31	12	4	0	3	26.8	29

3/3/2010 10:24	2223	248	126	71	34	17	7	1	0	3	26.9	29
3/3/2010 10:25	2364	295	143	92	46	20	9	3	0	3	27	29
3/3/2010 10:26	2228	276	156	105	55	21	10	2	0	3	27	29
3/3/2010 10:27	2184	247	114	78	42	23	9	2	0	3	27	29
3/3/2010 10:28	2060	267	133	87	42	22	10	4	0	3	27.1	29
3/3/2010 10:29	2219	236	117	75	41	16	6	1	0	3	27.1	29
3/3/2010 10:30	2138	265	139	94	50	27	11	5	0	3	27	29
3/3/2010 10:31	2147	282	148	104	55	21	6	2	0	3	27.2	29
3/3/2010 10:32	2116	264	141	94	50	21	7	2	0	3	27.2	29
3/3/2010 10:33	2047	251	123	91	52	23	5	0	0	3	27.3	29
3/3/2010 10:34	1971	252	130	92	59	20	8	1	0	3	27.3	29
3/3/2010 10:35	1958	203	105	63	30	16	8	5	0	3	27.3	29
3/3/2010 10:36	1943	233	122	85	43	23	10	3	0	3	27.4	29
3/3/2010 10:37	1966	218	112	85	52	24	9	2	0	3	27.4	29
3/3/2010 10:38	1924	210	101	66	36	18	9	1	0	3	27.4	28
3/3/2010 10:39	1902	210	113	85	44	22	6	1	0	3	27.4	28
3/3/2010 10:40	1969	221	113	76	42	22	9	2	0	3	27.4	29
3/3/2010 10:41	2136	361	197	127	56	25	11	2	0	3	27.4	29
3/3/2010 10:42	2134	323	172	105	53	26	8	1	0	3	27.6	29
3/3/2010 210:43	2053	283	161	96	54	22	7	1	0	3	27.5	29
3/3/2010 10:44	2032	267	145	108	70	33	17	3	0	3	27.6	29
3/3/2010 10:45	2006	284	145	93	47	22	7	3	0	3	27.7	28
3/3/2010 10:46	2009	253	131	92	50	26	9	3	0	3	27.5	28
3/3/2010 10:47	1980	290	173	122	67	35	18	7	0	3	27.5	29
3/3/2010 10:48	1941	227	122	74	45	23	10	2	0	3	27.7	28
3/3/2010 10:49	1907	199	103	76	42	21	9	0	0	3	27.7	28
3/3/2010 10:50	2007	266	154	102	60	30	11	5	0	3	27.7	28
3/3/2010 10:51	1821	205	111	86	44	19	9	2	0	3	27.7	28
3/3/2010 10:52	1899	212	110	72	35	19	9	2	0	3	27.8	28
3/3/2010 10:53	1886	258	136	94	51	19	9	3	0	3	27.8	28

3/3/2010 10:54	1972	310	166	117	57	42	14	4	0	3	27.8	28
3/3/2010 10:55	2044	278	161	116	70	41	17	4	0	3	27.8	29
3/3/2010 10:56	2174	266	139	106	59	29	14	5	0	3	27.8	28
3/3/2010 10:57	2265	297	167	122	70	32	17	8	0	3	27.9	29
3/3/2010 10:58	2400	296	169	122	78	28	12	4	0	3	27.8	28
3/3/2010 10:59	2930	471	262	178	94	43	20	5	0	3	27.9	28
3/3/2010 11:00	3254	506	258	168	82	40	13	4	0	3	27.8	28
3/3/2010 11:01	3055	399	225	145	82	40	11	5	0	3	27.9	28
3/3/2010 11:02	3168	389	225	169	99	43	21	8	0	3	27.9	28
3/3/2010 11:03	3145	418	269	193	109	55	21	5	0	3	27.9	28
3/3/2010 11:04	3234	363	227	154	86	35	14	5	0	3	28	29
3/3/2010 11:05	3187	387	224	167	94	41	14	3	0	3	27.9	28
3/3/2010 11:06	3095	402	256	184	113	58	28	4	0	3	27.9	28
3/3/2010 11:07	3128	464	299	225	138	67	25	12	0	3	27.9	28
3/3/2010 11:08	3089	440	291	224	133	65	24	9	0	3	28	28
3/3/2010 11:09	2852	389	230	165	99	49	14	2	0	3	27.9	28
3/3/2010 11:10	2990	516	340	245	147	61	17	8	0	3	28	28
3/3/2010 11:11	3298	803	519	346	177	63	19	3	0	3	27.8	28
3/3/2010 11:12	3525	967	622	407	193	78	22	6	0	3	28.1	28
3/3/2010 11:13	3082	667	435	313	172	73	31	5	0	3	28	28
3/3/2010 11:14	3164	776	526	356	174	53	18	5	0	3	28	28
3/3/2010 11:15	2800	566	375	267	134	61	26	8	0	3	28.1	28
3/3/2010 11:16	2523	475	298	225	132	63	26	6	0	3	28	28
3/3/2010 11:17	2488	413	243	170	98	49	18	2	0	3	28	28
3/3/2010 11:18	2474	472	298	222	128	56	20	8	0	3	28	28
3/3/2010 11:19	2307	363	235	181	102	48	16	3	0	3	28.1	28
3/3/2010 11:20	3354	1013	634	427	184	54	11	2	0	3	28.1	28
3/3/2010 11:21	3202	1001	661	458	226	100	41	2	0	3	28.1	28
3/3/2010 11:22	3255	1004	647	463	217	84	30	8	0	3	28.2	28
3/3/2010 11:23	2971	828	556	387	193	73	27	8	0	3	28.1	28

3/3/2010 11:24	2874	759	468	335	181	70	19	1	0	3	28.1	28
3/3/2010 11:25	3040	779	461	318	140	62	30	9	0	3	28.1	28
3/3/2010 11:26	2847	710	439	290	142	61	15	2	0	3	28.4	28
3/3/2010 11:27	2551	581	367	236	113	45	13	2	0	3	28.1	28
3/3/2010 11:28	2498	560	364	250	126	63	23	5	0	3	28.2	28
3/3/2010 11:29	2544	641	414	277	155	69	33	11	0	3	28.1	28
3/3/2010 11:30	4072	1592	936	573	248	79	25	7	0	3	28.2	28
3/3/2010 11:31	4518	2009	1394	920	432	133	46	4	0	3	28.2	28
3/3/2010 11:32	4083	1657	1054	653	286	93	28	2	0	3	28.2	28
3/3/2010 11:33	4560	1916	1213	803	356	130	37	5	0	3	28.2	28
3/3/2010 11:34	3546	1344	823	538	232	88	23	4	0	3	28.2	28
3/3/2010 11:35	3088	998	652	413	182	68	21	7	0	3	28.2	28
3/3/2010 11:36	2791	806	502	339	148	45	12	1	0	3	28.2	28
3/3/2010 11:37	2632	751	477	329	154	58	23	5	0	3	28.2	28
3/3/2010 11:38	3081	958	594	370	164	74	27	9	0	3	28.2	28
3/3/2010 11:39	3538	1264	792	504	217	85	24	1	0	3	28.2	28
3/3/2010 11:40	3102	1002	630	399	175	67	20	3	0	3	28.2	28
3/3/2010 11:41	3076	920	582	351	164	59	15	3	0	3	28.3	28
3/3/2010 11:42	3181	1060	657	416	195	61	21	5	0	3	28.1	28
3/3/2010 11:43	2906	822	513	326	160	68	22	5	0	3	28.1	28
3/3/2010 11:44	2578	703	431	291	138	59	23	6	0	3	28.1	28
3/3/2010 11:45	2440	673	459	321	181	83	38	16	0	3	28.1	28

Time and Date	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
3/10/2010 9:14	5372	461	189	119	62	33	13	5	0	2.9	20.1	62
3/10/2010 9:15	4872	431	168	111	76	36	14	7	0	3	20.4	62

3/10/2010 9:16	4775	417	165	115	60	38	11	4	0	3	20.6	61
3/10/2010 9:17	4535	442	211	142	79	42	15	9	0	3	20.8	60
3/10/2010 9:18	4461	405	181	115	63	28	13	3	0	3	21.2	59
3/10/2010 9:19	4309	388	135	87	45	24	9	4	0	3	21.6	58
3/10/2010 9:20	4261	408	175	86	49	26	10	3	0	3	21.9	57
3/10/2010 9:21	4217	427	159	96	50	27	13	3	0	3	22.3	56
3/10/2010 9:22	4090	362	157	93	53	29	16	8	0	3	22.7	56
3/10/2010 9:23	3950	359	146	82	47	27	8	1	0	3	23.1	54
3/10/2010 9:24	3951	366	128	81	40	26	10	2	0	3	23.5	54
3/10/2010 9:25	3812	405	157	97	57	27	8	3	0	3	23.7	53
3/10/2010 9:26	3635	297	106	56	32	20	8	3	0	3	24.2	52
3/10/2010 9:27	3622	344	134	77	41	26	16	4	0	3	24.6	51
3/10/2010 9:28	3448	296	98	60	28	20	9	2	0	3	24.9	50
3/10/2010 9:29	3639	344	132	80	43	19	8	3	0	3	25.1	49
3/10/2010 9:30	3453	322	122	62	30	10	3	0	0	3	25.6	48
3/10/2010 9:31	3565	386	146	84	39	15	5	3	0	3	25.8	48
3/10/2010 9:32	3645	398	148	91	53	22	12	5	0	3	26.3	47
3/10/2010 9:33	3683	355	148	92	57	32	11	1	0	3	26.5	47
3/10/2010 9:34	3493	413	162	94	48	25	10	4	0	3	26.8	46
3/10/2010 9:35	3569	386	161	88	42	20	10	4	0	3	27	46
3/10/2010 9:36	3642	381	156	93	46	21	10	3	0	3	27.3	46
3/10/2010 9:37	3511	347	145	88	39	18	5	1	0	3	27.4	46
3/10/2010 9:38	3445	338	119	65	25	11	6	2	0	3	27.7	45
3/10/2010 9:39	3369	385	139	83	42	19	4	1	0	3	27.8	45
3/10/2010 9:40	3458	362	127	78	42	15	3	1	0	3	28	45
3/10/2010 9:41	3328	333	129	70	39	18	8	3	0	3	28.1	45
3/10/2010 9:42	3400	367	138	88	47	18	8	1	0	3	28.2	45
3/10/2010 9:43	3474	420	185	103	52	24	8	3	0	3	28.3	45
3/10/2010 9:44	3302	351	145	76	40	18	9	2	0	3	28.4	45
3/10/2010 9:45	3094	318	133	75	31	15	9	3	0	3	28.5	45

3/10/2010 9:46	3134	324	134	68	33	19	6	4	0	3	28.5	45
3/10/2010 9:47	3017	292	120	71	31	12	4	2	0	3	28.6	44
3/10/2010 9:48	3014	304	116	65	31	14	7	3	0	3	28.7	44
3/10/2010 9:49	3041	298	100	62	31	20	7	3	0	3	28.7	45
3/10/2010 9:50	2923	293	115	68	26	11	6	0	0	3	28.7	44
3/10/2010 9:51	3099	298	127	68	35	14	6	2	0	3	28.7	44
3/10/2010 9:52	2922	286	121	61	29	15	10	3	0	3	28.8	44
3/10/2010 9:53	2854	296	109	59	29	17	5	2	0	3	28.8	44
3/10/2010 9:54	2867	274	116	65	30	15	3	0	0	3	28.8	44
3/10/2010 9:55	2732	283	109	57	25	13	1	0	0	3	28.8	44
3/10/2010 9:56	2702	238	98	63	31	13	7	2	0	3	28.8	44
3/10/2010 9:57	2821	294	122	74	35	16	9	2	0	3	28.9	44
3/10/2010 9:58	2909	307	138	74	41	16	6	2	0	3	28.9	44
3/10/2010 9:59	2968	380	171	99	47	19	7	4	0	3	28.8	44
3/10/2010 10:00	2867	349	167	107	51	30	12	5	0	3	28.9	44
3/10/2010 10:01	2935	405	180	109	57	25	9	3	0	3	28.8	44
3/10/2010 10:02	2977	387	174	108	47	22	8	1	0	3	28.9	44
3/10/2010 10:03	2850	383	178	118	61	27	12	4	0	3	28.9	44
3/10/2010 10:04	2893	380	170	108	55	34	18	5	0	3	28.9	44
3/10/2010 10:05	2803	353	161	110	54	21	8	3	0	3	28.9	44
3/10/2010 10:06	3018	460	261	162	95	50	18	2	0	3	28.9	44
3/10/2010 10:07	2894	433	216	134	70	36	15	3	0	3	28.9	44
3/10/2010 10:08	2912	464	240	151	81	38	19	5	0	3	28.9	44
3/10/2010 10:09	2900	438	225	157	86	41	14	8	0	3	29	44
3/10/2010 10:10	2699	378	177	105	61	29	15	8	0	3	28.9	44
3/10/2010 10:11	2797	397	202	141	76	32	11	2	0	3	28.8	44
3/10/2010 10:12	3078	632	306	177	78	34	11	2	0	3	29	44
3/10/2010 10:13	2820	511	283	180	101	49	23	9	0	3	29	44
3/10/2010 10:14	2646	440	225	144	83	48	19	7	0	3	28.9	44
3/10/2010 10:15	2709	449	235	167	84	38	8	1	0	3	28.9	44

3/10/2010 10:16	2659	445	234	159	82	47	21	5	0	3	29	44
3/10/2010 10:17	2696	474	260	169	90	48	18	5	0	3	29	44
3/10/2010 10:18	2579	437	232	153	86	36	15	3	0	3	29	44
3/10/2010 10:19	2542	408	228	138	77	42	13	4	0	3	28.9	44
3/10/2010 10:20	2338	362	183	111	58	36	11	5	0	3	29	44
3/10/2010 10:21	2595	442	221	143	66	34	16	2	0	3	29	44
3/10/2010 10:22	2450	420	221	148	78	32	12	3	0	3	28.9	44
3/10/2010 10:23	2487	445	249	169	81	35	18	5	0	3	28.9	44
3/10/2010 10:24	2387	453	235	149	73	32	9	5	0	3	28.9	44
3/10/2010 10:25	2514	470	253	153	71	36	18	8	0	3	28.8	44
3/10/2010 10:26	2458	423	229	154	78	38	12	3	0	3	28.9	44
3/10/2010 10:27	2295	405	200	123	67	32	12	3	0	3	29	44
3/10/2010 10:28	2307	404	206	134	76	29	11	5	0	3	28.7	44
3/10/2010 10:29	2401	470	241	151	71	33	12	3	0	3	29	44
3/10/2010 10:30	2382	464	240	163	80	45	17	3	0	3	28.7	44
3/10/2010 10:31	2414	427	228	153	73	30	13	1	0	3	28.9	44
3/10/2010 10:32	2221	410	218	148	74	26	11	3	0	3	28.9	44
3/10/2010 10:33	2058	342	178	121	65	34	15	3	0	3	28.9	44
3/10/2010 10:34	2097	337	171	114	60	27	11	3	0	3	28.9	44
3/10/2010 10:35	2027	353	185	119	57	20	9	3	0	3	28.9	44
3/10/2010 10:36	2061	328	173	106	53	25	12	7	0	3	28.8	44
3/10/2010 10:37	1952	290	154	97	49	20	16	5	0	3	28.9	44
3/10/2010 10:38	1959	293	160	114	59	22	5	2	0	3	28.9	44
3/10/2010 10:39	1840	265	148	91	41	19	8	4	0	3	28.8	44
3/10/2010 10:40	1815	271	149	91	57	27	14	3	0	3	28.9	44
3/10/2010 10:41	1867	287	153	98	54	16	5	3	0	3	28.9	44
3/10/2010 10:42	1910	299	159	108	56	25	11	5	0	3	28.8	44
3/10/2010 10:43	2033	301	153	97	45	22	6	1	0	3	28.8	44
3/10/2010 10:44	2585	575	301	178	65	29	10	1	0	3	28.9	44
3/10/2010 10:45	2253	442	222	136	76	29	10	1	0	3	28.9	44

3/10/2010 10:46	2142	369	207	115	57	19	8	2	0	3	28.9	44
3/10/2010 10:47	2144	403	209	134	57	24	13	4	0	3	28.9	44
3/10/2010 10:48	2106	390	202	121	60	32	12	2	0	3	28.9	44
3/10/2010 10:49	2061	402	192	116	51	28	10	3	0	3	28.9	44
3/10/2010 10:50	2021	388	197	113	51	27	9	2	0	3	28.8	44
3/10/2010 10:51	2028	428	230	158	82	38	13	4	0	3	28.9	44
3/10/2010 10:52	2050	446	271	176	90	47	20	9	0	3	28.8	44
3/10/2010 10:53	2177	535	302	194	102	45	15	3	0	3	28.8	44
3/10/2010 10:54	2311	576	352	251	129	59	23	4	0	3	28.9	44
3/10/2010 10:55	2056	482	277	180	76	37	15	3	0	3	28.9	44
3/10/2010 10:56	1908	411	212	138	65	33	11	1	0	3	28.8	44
3/10/2010 10:57	1987	402	228	144	82	37	17	7	0	3	28.9	44
3/10/2010 10:58	1966	427	252	181	85	42	15	2	0	3	28.9	44
3/10/2010 10:59	1880	397	211	143	72	37	18	5	0	3	28.8	44
3/10/2010 11:00	1883	343	187	121	54	32	13	3	0	3	28.9	43
3/10/2010 11:01	1884	328	178	112	49	25	8	2	0	3	28.9	44
3/10/2010 11:02	1904	378	211	142	64	23	6	2	0	3	28.8	43
3/10/2010 11:03	2191	546	324	220	101	35	16	2	0	3	28.9	44
3/10/2010 11:04	2234	606	360	222	107	56	25	8	0	3	29.1	44
3/10/2010 11:05	2381	608	365	230	109	42	15	4	0	3	28.9	44
3/10/2010 11:06	2111	498	289	205	94	37	16	2	0	3	28.8	44
3/10/2010 11:07	2084	486	295	187	85	39	18	4	0	3	28.9	43
3/10/2010 11:08	2139	522	306	189	91	42	11	4	0	3	28.9	44
3/10/2010 11:09	2093	514	301	186	84	43	14	4	0	3	28.9	44
3/10/2010 11:10	2085	490	271	168	82	34	9	3	0	3	28.9	44
3/10/2010 11:11	2017	452	242	166	70	27	16	5	0	3	28.9	44
3/10/2010 11:12	2067	480	270	164	88	35	12	2	0	3	28.8	44
3/10/2010 11:13	1909	416	221	125	54	19	9	0	0	3	28.7	44
3/10/2010 11:14	1914	391	215	126	55	26	9	2	0	3	28.8	44
3/10/2010 11:15	1863	383	207	135	72	33	12	2	0	3	28.8	44

3/10/2010 11:16	1778	339	181	121	58	22	9	0	0	3	28.9	44
3/10/2010 11:17	1882	353	188	117	58	33	15	7	0	3	28.9	43
3/10/2010 11:18	1857	391	211	145	67	23	13	2	0	3	28.9	43
3/10/2010 11:19	1848	354	196	120	67	34	13	4	0	3	28.9	44
3/10/2010 11:20	1839	375	216	138	72	34	15	6	0	3	28.8	44
3/10/2010 11:21	1778	382	217	136	68	32	13	3	0	3	28.8	44
3/10/2010 11:22	3308	1046	554	292	118	40	16	4	0	3	28.8	44
3/10/2010 11:23	2090	588	320	203	106	44	19	2	0	3	28.8	44
3/10/2010 11:24	1892	467	274	175	92	37	20	3	0	3	28.9	44
3/10/2010 11:25	1729	391	214	130	73	27	10	3	0	3	28.8	44
3/10/2010 11:26	2130	638	373	236	113	44	19	4	0	3	28.9	44
3/10/2010 11:27	1879	449	249	167	92	45	17	7	0	3	28.9	44
3/10/2010 11:28	1809	457	276	184	92	43	15	2	0	3	28.8	44
3/10/2010 11:29	2317	789	492	311	148	53	23	4	0	3	28.9	44
3/10/2010 11:30	4562	2298	1432	898	365	138	33	6	0	3	28.9	44
3/10/2010 11:31	3519	1640	1006	595	226	82	20	8	0	3	28.8	44
3/10/2010 11:32	2812	1189	725	467	190	75	29	6	0	3	28.9	44
3/10/2010 11:33	2614	1056	698	450	192	87	36	8	0	3	28.9	44
3/10/2010 11:34	2941	1248	811	543	235	92	28	5	0	3	28.9	44
3/10/2010 11:35	2903	1263	805	524	213	101	33	8	0	3	28.9	44
3/10/2010 11:36	2586	1044	679	409	166	70	25	4	0	3	28.8	44
3/10/2010 11:37	2476	912	598	400	181	82	27	6	0	3	28.9	44
3/10/2010 11:38	2782	1027	622	381	174	69	20	2	0	3	28.8	44
3/10/2010 11:39	6351	3341	2032	1187	459	164	39	6	0	3	28.8	44
3/10/2010 11:40	3541	1499	880	545	207	80	24	4	0	3	28.8	44
3/10/2010 11:41	3634	1597	978	602	289	115	42	13	0	3	28.9	44
3/10/2010 11:42	3072	1167	718	468	240	99	43	16	0	3	28.8	44
3/10/2010 11:43	2715	981	554	368	176	78	35	7	0	3	28.7	44
3/10/2010 11:44	2604	911	552	361	156	63	21	1	0	3	28.9	44
3/10/2010 11:45	2505	824	502	314	156	62	14	3	0	3	28.8	44

3/10/2010 11:46	2431	762	432	265	140	60	22	3	0	3	28.8	44
3/10/2010 11:47	2470	825	503	337	185	72	30	8	0	3	28.8	44
3/10/2010 11:48	2822	1031	619	428	219	96	35	10	0	3	28.8	44
3/10/2010 11:49	2376	768	443	303	146	65	24	5	0	3	28.9	44
3/10/2010 11:50	2442	776	450	296	150	69	31	8	0	3	28.8	44

ime	Particle Count								Alarms	Flow(lpm)	AT(C)	RH(%)
	0.3 µm	0.5 µm	0.7 µm	1.0 µm	2.0 µm	3.0 µm	5.0 µm	10.0 µm				
3/10/2010 13:03	3164	949	489	293	126	55	23	4	0	2.9	27.9	44
3/10/2010 13:04	3366	975	497	304	156	70	34	15	0	3	27.9	44
3/10/2010 13:05	3239	966	514	328	169	87	33	8	0	3	27.9	44
3/10/2010 13:06	3336	1089	580	379	206	88	29	8	0	3	28	44
3/10/2010 13:07	3471	1100	601	384	193	102	44	9	0	3	28	44
3/10/2010 13:08	3353	1086	576	373	163	84	42	9	0	3	28.1	44
3/10/2010 13:09	3291	959	524	334	172	80	33	5	0	3	28.1	44
3/10/2010 13:10	2975	856	446	287	152	68	31	8	0	3	28.2	44
3/10/2010 13:11	2956	780	388	246	136	67	32	11	0	3	28.2	44
3/10/2010 13:12	2843	756	379	236	127	52	20	10	0	3	28.2	44
3/10/2010 13:13	2747	701	325	197	89	46	20	7	0	3	28.2	44
3/10/2010 13:14	2644	676	326	216	101	49	20	6	0	3	28.3	44
3/10/2010 13:15	2546	622	297	196	104	56	29	7	0	3	28.2	44
3/10/2010 13:16	2526	642	317	205	97	42	21	8	0	3	28.4	44
3/10/2010 13:17	2536	590	264	168	85	43	14	3	0	3	28.3	44
3/10/2010 13:18	2598	643	331	194	98	46	25	7	0	3	28.4	44
3/10/2010 13:19	2531	579	260	164	80	42	20	4	0	3	28.4	44
3/10/2010 13:20	2568	676	327	217	99	49	23	4	0	3	28.4	44
3/10/2010 13:21	2697	644	318	202	93	38	17	6	0	3	28.5	44

3/10/2010 13:22	2570	598	295	195	102	44	16	4	0	3	28.5	44
3/10/2010 13:23	2642	602	272	178	91	37	18	8	0	3	28.4	44
3/10/2010 13:24	2658	617	278	175	100	52	23	3	0	3	28.4	44
3/10/2010 13:25	2704	631	321	187	98	48	15	5	0	3	28.5	44
3/10/2010 13:26	2804	648	304	183	101	57	20	7	0	3	28.6	44
3/10/2010 13:27	2752	653	307	209	114	59	15	3	0	3	28.6	44
3/10/2010 13:28	2720	561	271	184	111	56	24	6	0	3	28.7	44
3/10/2010 13:29	2603	559	274	181	92	41	21	7	0	3	28.6	44
3/10/2010 13:30	2695	627	326	217	117	60	20	5	0	3	28.6	44
3/10/2010 13:31	2366	522	260	169	88	47	17	3	0	3	28.7	44
3/10/2010 13:32	2464	536	254	167	85	36	13	4	0	3	28.7	44
3/10/2010 13:33	2439	590	296	211	109	50	19	5	0	3	28.7	44
3/10/2010 13:34	2211	492	213	127	65	36	12	1	0	3	28.8	44
3/10/2010 13:35	2305	436	209	123	60	18	6	0	0	3	28.7	43
3/10/2010 13:36	2314	438	203	120	55	25	10	3	0	3	28.8	44
3/10/2010 13:37	2368	482	233	127	66	27	12	4	0	3	28.8	43
3/10/2010 13:38	2086	417	171	112	53	22	10	1	0	3	28.8	44
3/10/2010 13:39	2068	404	176	118	64	26	11	3	0	3	28.7	43
3/10/2010 13:40	2071	431	211	128	72	39	14	4	0	3	28.8	43
3/10/2010 13:41	2064	380	177	100	50	21	8	1	0	3	28.8	43
3/10/2010 13:42	1881	380	173	101	54	27	13	2	0	3	28.8	43
3/10/2010 13:43	1893	344	127	75	29	16	3	1	0	3	28.7	43
3/10/2010 13:44	1782	297	129	84	43	21	9	2	0	3	28.8	43
3/10/2010 13:45	1872	302	132	77	38	17	7	1	0	3	28.8	43
3/10/2010 13:46	1735	276	123	79	41	20	6	1	0	3	28.8	43
3/10/2010 13:47	1867	404	198	134	73	35	18	3	0	3	28.8	43
3/10/2010 13:48	1820	344	166	103	53	26	14	4	0	3	28.9	43
3/10/2010 13:49	1931	343	157	91	49	16	4	0	0	3	28.9	43
3/10/2010 13:50	1948	353	154	97	46	22	6	3	0	3	28.8	43
3/10/2010 13:51	2154	417	184	112	63	23	9	1	0	3	28.9	43

3/10/2010 13:52	2119	374	166	107	55	27	10	0	0	3	28.9	43
3/10/2010 13:53	2076	376	160	107	61	29	14	7	0	3	28.9	43
3/10/2010 13:54	2192	452	194	128	67	32	11	2	0	3	28.9	44
3/10/2010 13:55	2085	444	199	125	72	37	16	5	0	3	28.9	43
3/10/2010 13:56	2033	424	213	117	59	20	6	2	0	3	28.9	43
3/10/2010 13:57	2432	601	302	192	106	46	22	5	0	3	28.9	43
3/10/2010 13:58	2206	471	241	158	87	46	15	4	0	3	29	43
3/10/2010 13:59	1813	379	185	125	66	29	13	2	0	3	29	43
3/10/2010 14:00	1864	410	191	117	72	34	11	2	0	3	29.1	43
3/10/2010 14:01	1893	426	220	140	78	33	13	3	0	3	29	43
3/10/2010 14:02	1693	374	192	140	84	47	16	3	0	3	29	43
3/10/2010 14:03	1704	401	213	134	68	35	15	6	0	3	28.9	43
3/10/2010 14:04	1626	381	211	142	76	35	9	3	0	3	29.1	43
3/10/2010 14:05	1668	369	207	139	76	38	18	3	0	3	29.1	43
3/10/2010 14:06	1654	414	232	160	101	55	20	3	0	3	29.1	43
3/10/2010 14:07	1639	376	233	163	99	50	21	4	0	3	29	43
3/10/2010 14:08	1500	368	210	149	85	39	11	2	0	3	29.1	43
3/10/2010 14:09	1694	438	254	186	112	47	19	2	0	3	29	43
3/10/2010 14:10	1670	403	210	148	96	53	18	4	0	3	29.1	43
3/10/2010 14:11	1601	388	224	156	100	50	20	4	0	3	29	43
3/10/2010 14:12	1844	443	236	159	94	44	17	4	0	3	29.1	43
3/10/2010 14:13	1601	407	226	167	110	49	18	4	0	3	29	43
3/10/2010 14:14	1556	359	209	144	88	39	16	2	0	3	29.1	43
3/10/2010 14:15	1382	356	219	156	95	41	12	2	0	3	29.1	43
3/10/2010 14:16	1471	398	224	147	89	44	16	3	0	3	29.1	43
3/10/2010 14:17	1430	375	206	152	82	41	12	2	0	3	29.1	43
3/10/2010 14:18	1471	339	192	153	95	50	16	3	0	3	29.1	43
3/10/2010 14:19	1411	368	185	130	80	40	14	4	0	3	29.1	43
3/10/2010 14:20	1459	364	207	149	85	43	18	2	0	3	29.2	43
3/10/2010 14:21	1441	360	209	157	90	40	18	3	0	3	29.1	43

3/10/2010 14:22	1416	367	202	143	69	31	14	1	0	3	29.1	43
3/10/2010 14:23	1388	347	185	132	79	44	16	3	0	3	29.2	42
3/10/2010 14:24	1338	366	207	146	86	41	17	3	0	3	29.2	43
3/10/2010 14:25	1401	411	235	174	109	59	24	5	0	3	29.2	43
3/10/2010 14:26	1472	439	260	168	107	55	18	4	0	3	29.2	43
3/10/2010 14:27	1421	460	266	186	108	45	18	3	0	3	29.2	43
3/10/2010 14:28	1359	379	212	153	91	38	13	3	0	3	29.2	43
3/10/2010 14:29	1626	480	265	177	95	44	12	4	0	3	29.2	43
3/10/2010 14:30	1552	415	226	155	88	43	19	1	0	3	29.1	43
3/10/2010 14:31	1621	412	211	137	83	35	11	2	0	3	29.2	43
3/10/2010 14:32	1443	371	196	125	58	25	9	3	0	3	29.1	43
3/10/2010 14:33	1583	398	204	137	56	20	5	0	0	3	29.3	43
3/10/2010 14:34	2061	651	338	227	111	36	14	5	0	3	29.2	44
3/10/2010 14:35	1688	493	257	175	92	48	13	3	0	3	29.2	43
3/10/2010 14:36	1553	374	187	134	83	36	12	4	0	3	29.2	43
3/10/2010 14:37	1492	353	191	139	79	44	19	3	0	3	29.2	43
3/10/2010 14:38	1623	419	210	139	73	34	15	3	0	3	29.1	43
3/10/2010 14:39	1724	411	216	151	89	37	14	5	0	3	29.3	43
3/10/2010 14:40	1827	439	241	168	97	59	19	3	0	3	29.2	43
3/10/2010 14:41	1969	460	248	168	102	45	14	2	0	3	29.3	43
3/10/2010 14:42	1967	435	233	158	83	46	17	7	0	3	29.2	43
3/10/2010 14:43	1963	445	231	161	90	47	15	4	0	3	29.2	43
3/10/2010 14:44	2123	487	251	160	88	40	12	3	0	3	29.2	42
3/10/2010 14:45	2230	562	313	207	130	67	34	13	0	3	29.3	42
3/10/2010 14:46	2388	623	338	208	114	60	27	10	0	3	29.2	42
3/10/2010 14:47	2824	787	399	246	114	49	17	3	0	3	29.3	43
3/10/2010 14:48	3031	858	424	248	119	59	23	9	0	3	29.3	42
3/10/2010 14:49	2472	598	285	185	87	42	18	3	0	3	29.2	42
3/10/2010 14:50	2628	650	280	180	91	46	16	2	0	3	28.9	42
3/10/2010 14:51	2566	681	352	238	124	61	26	3	0	3	29.2	42

3/10/2010 14:52	2412	604	323	214	115	50	12	2	0	3	29.2	42
3/10/2010 14:53	2508	613	302	217	117	58	14	5	0	3	29.4	42
3/10/2010 14:54	2157	499	254	169	90	37	14	3	0	3	29.2	42
3/10/2010 14:55	2345	524	249	162	102	53	19	3	0	3	29.3	42
3/10/2010 14:56	2263	470	244	155	88	42	19	6	0	3	29.3	42
3/10/2010 14:57	2271	513	257	187	106	47	18	1	0	3	29.3	42
3/10/2010 14:58	2275	544	291	197	109	52	24	5	0	3	29.3	42
3/10/2010 14:59	2293	585	324	209	102	51	19	7	0	3	29.3	42
3/10/2010 15:00	3257	1305	804	520	229	88	24	4	0	3	29.2	42
3/10/2010 15:01	2524	797	453	284	122	51	14	4	0	3	29.2	43
3/10/2010 15:02	2162	529	263	179	100	53	22	5	0	3	29.3	42
3/10/2010 15:03	2084	480	252	162	99	41	15	5	0	3	29.3	43
3/10/2010 15:04	2300	586	315	207	93	38	13	1	0	3	29.3	42
3/10/2010 15:05	2210	524	281	189	111	48	14	4	0	3	29.3	42
3/10/2010 15:06	2115	452	212	132	63	33	11	2	0	3	29.3	42
3/10/2010 15:07	2120	455	227	159	81	41	15	2	0	3	29.3	43
3/10/2010 15:08	2214	478	250	169	88	42	13	5	0	3	29.3	42
3/10/2010 15:09	2274	479	258	176	101	58	20	5	0	3	29.2	42
3/10/2010 15:10	2199	530	282	202	136	68	24	6	0	3	29.3	43
3/10/2010 15:11	2308	576	330	244	148	74	31	9	0	3	29.2	43
3/10/2010 15:12	2362	551	314	223	131	68	27	6	0	3	29.3	43
3/10/2010 15:13	2374	540	312	233	143	64	27	7	0	3	29.2	43
3/10/2010 15:14	2505	647	384	281	169	92	36	7	0	3	29.3	43
3/10/2010 15:15	2310	554	291	222	132	62	23	5	0	3	29.3	43
3/10/2010 15:16	2301	514	277	195	118	57	14	3	0	3	29.2	42
3/10/2010 15:17	2310	512	257	189	125	60	25	10	0	3	29.3	43
3/10/2010 15:18	2256	462	258	180	95	40	15	2	0	3	29.3	43
3/10/2010 15:19	2203	436	232	159	81	35	9	1	0	3	29.2	42

APPENDIX D: STATISTICAL ANALYSIS PROGRAMS

SAS Program Editor – Air Monitor Data Analysis

```
dm'log; clear; output; clear';
%include'F:\Statistics\pdmix800.sas';
title' ';

libname aero 'F:\Statistics';
odsrtffile='F:\Statistics\Stuff292810.doc';
/*
proc contents data=aero.bioaerosol;
run;
proc print data=aero.bioaerosol;
run;
*/

DATA ONE;
INFILE CARDS MISSOVER;
INPUT CAT $ DATE $ 5-15 SESSION SIZE Y;
ly = log(Y);
IX = 1/SIZE;
*INPUT CAT $ DATE MMDDYY10. SESSION SIZE Y;
IF SIZE EQ 0.3THENDELETE;
*---+----1----+----2----+----3;
DATALINES;

BL   2/10/2010   1   0.3   1172
BL   2/10/2010   2   0.3   820
BL   2/10/2010   3   0.3   909
BL   2/11/2010   1   0.3   3100
BL   2/25/2010   1   0.3   1135
BL   3/10/2010   1   0.3   1864
BL   2/10/2010   1   0.5   244
BL   2/10/2010   2   0.5   141
BL   2/10/2010   3   0.5   200
BL   2/11/2010   1   0.5   766
BL   2/25/2010   1   0.5   221
BL   3/10/2010   1   0.5   274
BL   2/10/2010   1   0.7   140
BL   2/10/2010   2   0.7   98
BL   2/10/2010   3   0.7   139
BL   2/11/2010   1   0.7   369
BL   2/25/2010   1   0.7   144
BL   3/10/2010   1   0.7   154
BL   2/10/2010   1   1   99
BL   2/10/2010   2   1   82
BL   2/10/2010   3   1   110
BL   2/11/2010   1   1   215
BL   2/25/2010   1   1   105
BL   3/10/2010   1   1   97
BL   2/10/2010   1   2   57
BL   2/10/2010   2   2   53
BL   2/10/2010   3   2   67
BL   2/11/2010   1   2   102
BL   2/25/2010   1   2   64
BL   3/10/2010   1   2   53
```

BL	2/10/2010	1	3	26
BL	2/10/2010	2	3	29
BL	2/10/2010	3	3	32
BL	2/11/2010	1	3	47
BL	2/25/2010	1	3	32
BL	3/10/2010	1	3	22
BL	2/10/2010	1	5	11
BL	2/10/2010	2	5	11
BL	2/10/2010	3	5	13
BL	2/11/2010	1	5	20
BL	2/25/2010	1	5	12
BL	3/10/2010	1	5	7
IC	2/10/2010	1	0.3	1582
IC	2/10/2010	2	0.3	982
IC	2/10/2010	3	0.3	1154
IC	2/11/2010	1	0.3	4524
IC	2/25/2010	1	0.3	1457
IC	3/10/2010	1	0.3	2327
IC	2/10/2010	1	0.5	499
IC	2/10/2010	2	0.5	244
IC	2/10/2010	3	0.5	391
IC	2/11/2010	1	0.5	1522
IC	2/25/2010	1	0.5	417
IC	3/10/2010	1	0.5	462
IC	2/10/2010	1	0.7	310
IC	2/10/2010	2	0.7	183
IC	2/10/2010	3	0.7	274
IC	2/11/2010	1	0.7	755
IC	2/25/2010	1	0.7	274
IC	3/10/2010	1	0.7	243
IC	2/10/2010	1	1	221
IC	2/10/2010	2	1	146
IC	2/10/2010	3	1	215
IC	2/11/2010	1	1	448
IC	2/25/2010	1	1	199
IC	3/10/2010	1	1	143
IC	2/10/2010	1	2	106
IC	2/10/2010	2	2	105
IC	2/10/2010	3	2	129
IC	2/11/2010	1	2	193
IC	2/25/2010	1	2	120
IC	3/10/2010	1	2	66
IC	2/10/2010	1	3	40
IC	2/10/2010	2	3	55
IC	2/10/2010	3	3	65
IC	2/11/2010	1	3	70
IC	2/25/2010	1	3	62
IC	3/10/2010	1	3	27
IC	2/10/2010	1	5	14
IC	2/10/2010	2	5	20
IC	2/10/2010	3	5	26
IC	2/11/2010	1	5	22
IC	2/25/2010	1	5	25
IC	3/10/2010	1	5	9
TC	2/10/2010	1	0.3	1265
TC	2/10/2010	2	0.3	903
TC	2/10/2010	3	0.3	1144
TC	2/11/2010	1	0.3	4039

```
TC    2/25/2010    1    0.3    1478
TC    3/10/2010    1    0.3    2215
TC    2/10/2010    1    0.5    301
TC    2/10/2010    2    0.5    196
TC    2/10/2010    3    0.5    413
TC    2/11/2010    1    0.5    1241
TC    2/25/2010    1    0.5    373
TC    3/10/2010    1    0.5    430
TC    2/10/2010    1    0.7    180
TC    2/10/2010    2    0.7    141
TC    2/10/2010    3    0.7    298
TC    2/11/2010    1    0.7    654
TC    2/25/2010    1    0.7    237
TC    3/10/2010    1    0.7    228
TC    2/10/2010    1    1    129
TC    2/10/2010    2    1    113
TC    2/10/2010    3    1    239
TC    2/11/2010    1    1    391
TC    2/25/2010    1    1    172
TC    3/10/2010    1    1    141
TC    2/10/2010    1    2    71
TC    2/10/2010    2    2    76
TC    2/10/2010    3    2    144
TC    2/11/2010    1    2    171
TC    2/25/2010    1    2    102
TC    3/10/2010    1    2    63
TC    2/10/2010    1    3    30
TC    2/10/2010    2    3    40
TC    2/10/2010    3    3    71
TC    2/11/2010    1    3    65
TC    2/25/2010    1    3    51
TC    3/10/2010    1    3    26
TC    2/10/2010    1    5    10
TC    2/10/2010    2    5    15
TC    2/10/2010    3    5    27
TC    2/11/2010    1    5    20
TC    2/25/2010    1    5    21
TC    3/10/2010    1    5    11

;

RUN;
procfreqdata=one;
tables date*session/ nocolnorow;
run;

Title'Proc Mixed Original Recipe';
PROCMIXEDDATA=ONE;
CLASS CAT DATE SESSION /*size*/;
MODELlY=CAT SIZE CAT*SIZE/ DDFM=KR OUTP=RESIDS;
*random date session(DATE);
*REPEATED SIZE / SUBJECT=session(DATE) TYPE=cs;
*LSMEANS CAT SIZE CAT*SIZE / PDIFF ADJUST=TUKEY CL;
*LSMEANS CAT SIZE CAT*SIZE / slice=size;
odsoutput diffs=ppplsmeans=mmm;
odslistingexclude diffs; *lsmeans;
run;
%pdmix800(ppp,mmm,alpha=0.01,sort=yes);
```

```
title'Procglm MODEL Y = IX CAT IX*CAT';

PROCGLMDATA=ONE; CLASS CAT;
MODEL Y = IX CAT IX*CAT / SOLUTION;
RUN;

title'Procglm MODEL Y = CAT IX*CAT';
PROCGLMDATA=ONE; CLASS CAT;
MODEL Y = CAT IX*CAT / nointSOLUTION;
RUN;

title'Procglm MODEL Y = IX*CAT';
PROCGLMDATA=ONE; CLASS CAT;
MODEL Y = IX*CAT / nointSOLUTION;
RUN;

/*proc print data=resids; run;*/

title'ProcUnivariate on Resids' ;
PROCUNIVARIATEDATA=RESIDS PLOTNORMAL;
VAR RESID;
RUN;

title'Isolating Session and Size';
data two; set one;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT DATE SESSION; run;
procmeansdata=two; by CAT DATE SESSION;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;
procprintdata=three; run;

Title'CAT DATE and SESSION ';
procglmdata=three;
class CAT DATE SESSION;
model  s2 s3 s4 s5 s6 s7 = cat;
repeated size profile;
*   manova h=cat;
run;

title' ';
procsortdata=one out=sortone;
bydescending cat;
run;

title2'With Size';

PROCMIXEDDATA=sortoneorder=data;
CLASS CAT;
```

```
MODELlY=CAT SIZE CAT*SIZE/ DDFM=KR OUTP=RESIDS solution;
run;

Title2'Without Size';
PROCMIXEDDATA=sortoneorder=data;
CLASS CAT;
MODELlY = CAT CAT*SIZE/ nointDDFM=KR OUTP=RESIDS solution;
run;

title' ';

*************************************************************************
***********;

data noble6;
set one;
if date='2/11/2010'thendelete;
run;

title'Without 2/11/2010';
PROCMIXEDDATA=noble6;
CLASS CAT DATE SESSION /*size*/;
MODELlY=CAT SIZE CAT*SIZE/ DDFM=KR OUTP=RESIDS;
*random date session(DATE);
*REPEATED SIZE / SUBJECT=session(DATE) TYPE=cs;
*LSMEANS CAT SIZE CAT*SIZE / PDIFF ADJUST=TUKEY CL;
*LSMEANS CAT SIZE CAT*SIZE / slice=size;
odsoutput diffs=ppplsmeans=mmm;
odslistingexclude diffs; *lsmeans;
run;
%pdmix800(ppp,mmm,alpha=0.01,sort=yes);

title' ';

procsortdata=one out=cat1;
by cat;
run;

procgplotdata= cat1;
plot Y*size=CAT / hminor=0;
by cat;
run;

procgplotdata= cat1;
plot Y*size=CAT / hminor=0;
run;
odsrtfclose;
quit;
```

SAS Program Editor – Air Monitor Data Analysis: Isolated Trials

```
dm'log; clear; output; clear';
*libname work 'F:\Statistics';
*ods rtf file='F:\Statistics\isolatedtrials.doc';

dm'log; clear; output; clear';
```

```
%include'F:\Statistics\pdmix800.sas';
title' ';

/*
PROC IMPORT OUT= WORK.IsolatedTrials
            DATAFILE= "F:\Statistics\Isolated Trials.xls"
            DBMS=EXCEL REPLACE;
     RANGE="Sheet1$";
     GETNAMES=YES;
     MIXED=NO;
     SCANTEXT=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;
*/

procsortdata=work.IsolatedTrialsout=ZZZ;
by Trial cat Size;
run;

data A;
set ZZZ;
if Trial ne 'A'thendelete;
run;

data B;
set ZZZ;
if Trial ne 'B'thendelete;
run;

data C;
set ZZZ;
if Trial ne 'C'thendelete;
run;

data D;
set ZZZ;
if Trial ne 'D'thendelete;
run;

data E;
set ZZZ;
if Trial ne 'E'thendelete;
run;

data F;
set ZZZ;
if Trial ne 'F'thendelete;
run;

title'Trial A';
data two;
      set A;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
```

```
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;

title'Trial B';
data two;
      set B;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;

title'Trial C';
data two;
      set C;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;


title'Trial D';
data two;
```

```
      set D;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;

title'Trial E';
data two;
      set E;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;

title'Trial F';
data two;
      set F;
array s (7) s1 s2 s3 s4 s5 s6 s7;
if size eq0.3then s1 = y;
if size eq0.5then s2 = y;
if size eq0.7then s3 = y;
if size eq1then s4 = y;
if size eq2then s5 = y;
if size eq3then s6 = y;
if size eq5then s7 = y;
run;
procsortdata=two; by CAT Trial; run;

title2'Proc Means';
procmeansdata=two nmeanstdclm;
      by CAT Trial;
var s1 s2 s3 s4 s5 s6 s7;
```

```
outputout=three mean = s1 s2 s3 s4 s5 s6 s7;
run;

*ods rtf close;
quit;
```

SAS Program Editor – Survey Data Analysis

```
dm'log; clear; output; clear';

libname doctor 'F:\Statistics';
*ods rtf file='F:\Statistics\one.doc';

*You can change DOCTOR to WORK. Make sure to change it EVERYWHERE!;

PROCIMPORTOUT= DOCTOR.goodstuff
DATAFILE= "F:\Statistics\collective survey.xls"
DBMS=EXCEL REPLACE;
     RANGE="GoodStuff$";
     GETNAMES=YES;
     MIXED=NO;
     SCANTEXT=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;

/*The variable HIS was left out of the logistic analysis because all answers
were 'No'*/

data work.DH1DH2;
setdoctor.goodstuff;
dropClinHrPScaleHScale Type HEvacLEvac Mask;
ifClinWk='.'thendelete;
if Age='.'thendelete;
if Sex='.'thendelete;
if Race='.'thendelete;
if Smoke ='.'thendelete;
if Flu08='.'thendelete;
if Flu09='.'thendelete;
if HOR='.'thendelete;
if ill='.'thendelete;
run;

procprintdata=DH1DH2;
run;

title'DH1 and DH2';
proclogisticdata=work.DH1DH2;
class Group ClinWk Age Sex Race Smoke Flu08 Flu09 HOR /*HIS*// param=glm;
model ill (event='Y') = Group ClinWk Age Sex Race Smoke Flu08 Flu09 HOR
/*HIS*//
      selection=backward slentry=0.10slstay=0.05;
      outputout=next03 p=probl=lower u=upper;
run;

data work.DH2;
```

```
setdoctor.goodstuff;
if Group='DH1S1'thendelete;
if Group='DH1S2'thendelete;
ifHScale=1then H1='Y';
ifHScale=2then H1='Y';
ifHScale=3then H1='Y';
ifHScale=4then H1='N';
ifHScale=5then H1='N';
ifClinWk='.'thendelete;
if Age='.'thendelete;
if Sex='.'thendelete;
if Race='.'thendelete;
if Smoke ='.'thendelete;
if Flu08='.'thendelete;
if Flu09='.'thendelete;
ifClinHr='.'thendelete;
ifPScale='.'thendelete;
if Type='.'thendelete;
ifHEvac='.'thendelete;
ifLEvac='.'thendelete;
if Mask='.'thendelete;
if HOR='.'thendelete;
if ill='.'thendelete;
run;

title'DH2 all variables';
proclogisticdata=work.DH2;
class Group ClinWk Age Sex Race Smoke Flu08 Flu09 ClinHr H1 PScale Type
HEvacLEvac
            Mask HOR /*HIS*// param=glm;
model ill (event='Y') = Group ClinWk Age Sex Race Smoke Flu08 Flu09 ClinHr H1
PScale Type HEvac
                  LEvac Mask HOR /*HIS*//
      selection=backward slentry=0.10slstay=0.05;
      outputout=next02 p=probl=lower u=upper;
run;

title'DH1 and DH2 Shared variables';
procsortdata=next03 nodupkeyout=sorted;
by flu08;
run;

dataloki;
set sorted;
keep flu08 prob lower upper;
run;

title' ';

title'Does Flu Shot Cause Sickness?';

procfreqdata=work.DH1DH2;
table Flu08*Ill/ norownocolexpectednopercentchisq;
run;
title' ';

procfreqdata=work.DH1DH2;
run;
```

```
/*
*Here is your raw data without deleting the missing observations;
proc print data=doctor.goodstuff;
run;
*/
*ods rtf close;

quit;
```

VITA

Christen Rebecca Gautreau was born in Baton Rouge, Louisiana, in 1982. Her parents along with her older sister were living in the nearby city of Gonzales, Louisiana, at the time. Her mother, a nurse by profession, had chosen to stay home with her children until they started school, while her father was building a hardware business in Donaldsonville, Louisiana. Just before Christen's fourth birthday, her father moved the whole family to Donaldsonville. Living in a small town and attending a small Catholic school, Christen enjoyed being active in many school activities and groups as well as close relationships that can only be born out of spending 12+ years with the same group of people. Christen could not wait to take on the world and start college. Receiving a full scholarship, she chose Centenary College in Shreveport, Louisiana. She entered college majoring in political science hoping to eventually become a lawyer. It took only a few short months for her to realize political science was just not the right fit for her. She changed her major a few times, eventually settling on the field of psychology. Around her junior year of college, she began to miss her family in south Louisiana and decided to transfer to Louisiana State University in Baton Rouge. She completed her undergraduate in May of 2006 with a major in psychology and a minor in religious studies. She decided to take some time away from school the following year, but it didn't take long for her to realize she needed some intellectual stimulation. Desiring to do mission work but also becoming increasingly interested in the environmental field, she decided to start classes part-time at LSU in the fall of 2007 in Environmental Science Department. It was in this first semester that she was first introduced to the field of toxicology by Dr. Vincent Wilson. She was hooked! She continued the year part-time and officially entered the department as a Master of Science candidate in the fall of 2008. She chose to focus her studies primarily on toxicology and water quality, taking many classes outside of the department to achieve a broader range of knowledge. She will complete her degree with a Master of Science in environmental sciences in December 2010.