



*Special Carlisle Area Fine Particulate Air Monitoring Study
Final Report*

April 3, 2009

**Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Air Quality**

**Edward G. Rendell, Governor
Commonwealth of Pennsylvania**

**John Hanger, Secretary
Department of Environmental Protection**

Executive Summary

Carlisle, Pennsylvania, which is located at the crossroads of Interstate 81 and the Pennsylvania Turnpike in Cumberland County, has attracted a concentration of trucking and warehousing facilities along the Route 11 stretch that connects the two limited-access highways. Statistics show nearly 12,000 people work in the trucking, warehousing and supporting industries at more than 160 different locations in Cumberland County.

Airborne particles with a diameter of 2.5 micrometers or less are considered “fine particulate matter,” and are referred to as PM_{2.5}. Diesel emissions from trucks are one of the sources that emit fine particulate matter. As a result of concerns raised by local residents due to the increased emissions from the truck traffic, the Clean Air Board of Central Pennsylvania (CAB) requested a study to obtain air quality readings from a sampling location closer to the mobile emissions and upwind of downtown Carlisle. In late April 2006, then Secretary McGinty announced that the Department of Environmental Protection (Department) would conduct a 1-year PM_{2.5} sampling study in the Carlisle area.

Working in partnership with area residents and the Clean Air Board of Central Pennsylvania (CAB), the Department has been conducting an ambient air quality study focusing on fine particulate matter (PM_{2.5}) in the Carlisle area. The temporary special study site was located at 1000 Walnut Street in Carlisle for this study and it has collected PM_{2.5} data from May 10, 2007, through September 30, 2008. In accordance with the siting regulations set forth in 40 CFR Part 58, Appendix D, the Department monitors PM_{2.5} at two other sites in the Harrisburg-Carlisle Metropolitan Statistical Area (MSA) as part of its EPA-approved monitoring network – the Imperial Court site in Carlisle (since 2001) and the Harrisburg site located off of 19th Street in Harrisburg (since 1999).

On April 21, 2008, the Department met with members of the CAB to discuss the findings. Following the meeting, a joint decision was made to continue monitoring until September 30, 2008, since there was a period of missing data from the summer of 2007.

The Department collected PM_{2.5} data from May 10, 2007 to September 30, 2008. The data observations indicate that the special study Walnut Street site recorded higher concentrations than the Imperial Court site by 5%. The data observations also indicate that both sites exceeded the 24-hour PM_{2.5} National Ambient Air Quality Standard (NAAQS). The statistical T-test analysis concluded that there is no significant difference between the annual arithmetic means of these two monitoring sites.

Introduction

Background

Airborne particles with a diameter of 2.5 micrometers or less are considered “fine particulate matter,” and are referred to as PM_{2.5}. While the nature of the fine particles are complex, common constituents include sulfate, nitrate, ammonium, elemental carbon, a variety of organic carbon compounds, and other inorganic materials. Sources of fine particles include all types of combustion activities (motor vehicles, power plants, wood burning, etc.) and industrial processes.

Based on information reviewed by the U.S. Environmental Protection Agency (EPA), health studies have shown an association between exposure to fine particles and premature mortality. Other important effects include aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions, emergency room visits, absences from school or work or restricted activity days), lung disease, decreased lung function, asthma attacks, and certain cardiovascular problems such as heart attacks and cardiac arrhythmia. Individuals particularly sensitive to fine particle exposure include older adults, people with heart and lung disease, and children.

EPA regulates PM_{2.5} using the National Ambient Air Quality Standards (NAAQS). The current primary (health-based) NAAQS for PM_{2.5} are a limit of 35 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), based on 24-hour average concentrations, and 15 $\mu\text{g}/\text{m}^3$ based on an annual average.

In late April 2006, former Secretary McGinty announced that the Department of Environmental Protection (Department) would conduct a one-year PM_{2.5} sampling study in the Carlisle area due to public concerns about problems with diesel emissions and truck idling. The Department announced that it would dedicate as much as \$75,000 in services, including equipment, site preparation, labor, and laboratory work and data analysis. The Secretary's April 21, 2006, Press Release made references to the Miracle Mile (Route 11) and to the fact that the goal of the study was to obtain accurate readings of the local air quality, but that measured levels of particulate pollution could not be used to indicate a source.

EPA Requirements

Siting Regulations – As required in 40 CFR Part 58 Appendix D, the Department is required to have a minimum of two (2) air monitoring sites for PM_{2.5} based on the population of the Harrisburg-Carlisle Metropolitan Statistical Area (MSA). The network plan that was submitted to EPA in 1999, and ultimately approved, proposed sites in Carlisle (located at Imperial Court) and Harrisburg (located at 19th and Gibson Streets) to determine compliance with the NAAQS. The sites were chosen at locations that would be most representative of the largest population possible. Newly promulgated EPA regulations explicitly state that

most PM_{2.5} monitors should be deployed at neighborhood scales and larger, meaning the samplers are far enough from large emission sources that they represent the fairly uniform air quality across an area with dimensions of at least a few kilometers. This type of siting requirement is to promote the concept of community-oriented (CORE), population-oriented, and thus, Neighborhood Scale monitoring sites.

Comparison to the PM_{2.5} Annual Standard - EPA regulations are very clear in defining areas that may NOT be compared to the annual standard, saying that such monitors "...sited in relatively unique population-oriented microscale areas, localized hotspots, or unique population-oriented middle-scale areas..." may NOT be compared to the annual PM_{2.5} National Ambient Air Quality Standard (NAAQS). Concentrations gathered in such areas may only be compared to the 24-hour NAAQS.

Although PM_{2.5} does not have large concentration gradients moving away from a potential source, motor vehicle emissions do contribute to ambient levels of particle concentrations in urban areas. Therefore, once the spatial scale is selected (in this case, the Neighborhood Scale), the location of sampler within the urbanized area, specifically, relative to major roadways, must meet required setbacks (distances from roads). These spacing setbacks are necessary to promote national consistency in sampler siting and to help ensure that the data from the sampler is indeed representative of the area in question, thus minimizing/eliminating any effect of the wind direction on sampler location.

Special Study Site Selection

DEP staff, in cooperation with the Clean Air Board of Central Pennsylvania (CAB), was involved in the special study site selection process that began in May 2006 and continued through January 2007. Over the ensuing months, many prospective sites in the Carlisle area were considered. Around May 2006, CAB provided to the Department a list of 18 potential sites. The list was eventually narrowed down to five sites judged to have the most potential. These sites were Claremont Nursing Home, Carlisle Airport, Embarq Parking Lot, Carlisle Hospital and Dickson College Intramural Fields. The Bureau of Laboratories Mobile Analytical Unit (MAU) performed several days of testing at these five sites by using carbon monoxide monitoring as a surrogate for mobile emissions. DEP staff used data from these tests to aid in the final site recommendation process. These sites are shown in Figure 1.

In this regard, there was some concern about the selection of a prospective site that was south of Interstate 81 (I-81 runs almost due east/west near Carlisle). Three of the 5 sites visited were south of I-81; traffic on the interstate was visible from most of the prospective sites. A decision was made not to rule out any site because of its proximity to I-81, as long as it met EPA setback requirements (for I-81, the setback is 100 meters).

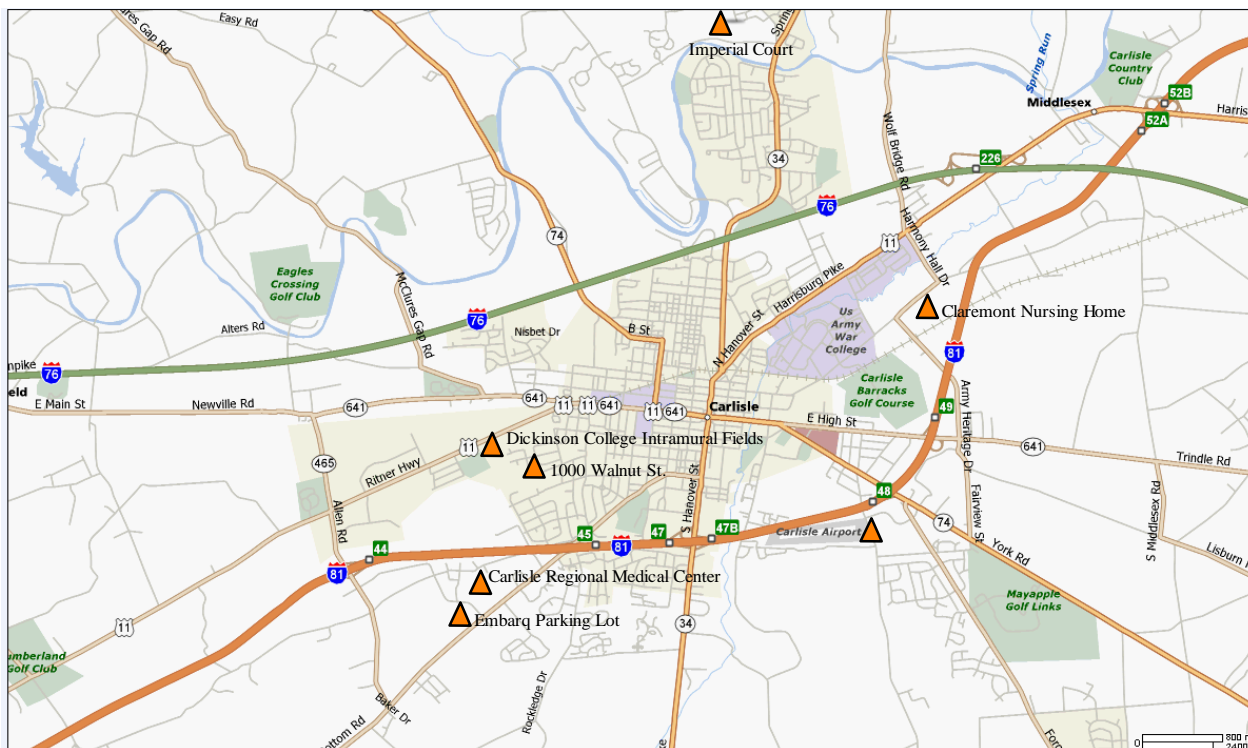


Figure 1. Map of Potential PM_{2.5} Special Study Monitoring Sites

Department Special Study Site Recommendations

In addition to the data collected from the MAU, DEP staff took into account several other factors, including: the proximity of the potential site to mobile and stationary particulate sources, the predominant wind direction(s), and most importantly population/land use of the surrounding area relating to EPA monitoring requirements. DEP staff proposed the following two sites to be considered for selection as the special study PM_{2.5} FRM sampling site in the Carlisle area. In order of preference, they were:

Clarendon Nursing Home - The Clarendon Nursing Home is less than 2 miles from the center of Carlisle. There is potential for particulate matter impact on this sampler from several directions. In addition to supporting wind rose data, the site is very close to a major portion of the borough. The site is also relatively close to I-81 and is the closest prospective site to the Miracle Mile (a portion of US-11 between I-81 and the Pennsylvania Turnpike). Carbon monoxide (CO) concentrations (used as our surrogate pollutant) at the Nursing Home were also among the highest recorded by the MAU. Using wind data taken by the MAU during the sampling event, many elevated CO concentrations occurred on days that coincided with the winds coming from Carlisle. This site was judged the most representative location to characterize the air mass that moved across the majority of the Carlisle area.

Carlisle Airport - The CO data recorded here by the MAU was consistently the highest on all 6 sampling days. The site is also close to I-81. It is also interesting that, using wind data taken during the MAU sampling event, elevated CO concentrations were largely independent of the wind direction. However, because of the largely rural setting of the immediately surrounding terrain, the feeling was that this site was not located close enough to the population center, thus the site became the Department's second choice.

The Department did not recommend the Embarq Parking Lot, Carlisle Hospital and the Dickinson College Intramural Fields as prospective sites for the PM_{2.5} monitoring study. All three of these sites are in the upwind direction of the Carlisle Metropolitan Area. The Carlisle Hospital is not far from the Embarq Parking lot. The Dickinson College Intramural Fields are about 1.5 miles from the Embarq Parking lot. Dickinson College Intramural Fields have other characteristics that made it difficult to establish a sampling site in this area – namely the high volume of student traffic and that the utilities were underground in the area of the fields, complicating electrical hook-up. No reasonable alternative sites within that area could be found that meet EPA siting requirements.

CAB Special Study Site Recommendation

Of the five possible sites, CAB representatives favored the Embarq Parking lot and Carlisle Hospital sites. CAB wanted the site to be located on the west side of town and preferably closer to the expanding warehouse district. They suggested the sampler should be between the warehouse district and the residents of Carlisle. CAB quoted the particulate concentrations taken by a private contractor, who conducted a one-day sampling event at various locations in the borough, versus the results of several days of testing by the MAU. CAB also relied on a wind rose from the Harrisburg International Airport to characterize the predominant wind direction for the Carlisle Area.

Mr. Tom Benjey (CAB) sent an email dated January 2, 2007, in which CAB recommended two new sites, at 1000 and 1100 Walnut Street, which are on the southwest side of town. These new proposed sites are approximately ½-mile from a site at which the MAU sampled during the summer of 2006, identified in the laboratory report as "Dickinson College". As explained by Mr. Benjey, the sites are on farmland, but are on the border of an urbanized area. Mr. Benjey also mentioned that this site was over 500 meters from I-81 and Route 11 and was on the western edge of the Borough of Carlisle.

The Department had several concerns about this site because this newly recommended site was only ¼ miles northeast from the two sites that CAB was originally recommending. The two new sites (as well as the two previously recommended CAB sites) are upwind of a major portion of Carlisle Borough, and downwind of predominately a rural area, except for an existing warehouse property that starts approximately 500 meters west of the proposed site.

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Locating the sampler near these local sources raised considerable concern for the Department, with the possibility that the sampling results could be biased upwards and therefore not representative of the typical population exposure of the Carlisle Area.

Final Selection of the Walnut Street Site

On February 2, 2007, Ted Erdman from EPA Region III in Philadelphia visited the sites that were being considered for the PM_{2.5} study and provided his input on the site selection process. On February 22, 2007, the Department sent an email to Pam Frohman (CAB) indicating that EPA has no objections to using the 1100 Walnut Street site for the PM_{2.5} monitoring study. However, EPA warned about the possibility of wood burning in the winter and outdoor grilling in the summer on or near the Walnut Street site that could elevate the PM_{2.5} readings.

At the request of the Clean Air Board, the Walnut Street Site was ultimately chosen to be the site for the PM_{2.5} study. The monitoring equipment was installed in April 2007 and PM_{2.5} sampling began on May 10, 2007.

The location of the existing official attainment compliance site at Imperial Court and the temporary PM_{2.5} special study site at Walnut Street (Carlisle West) are shown in Figure 2.

Carlisle Monitoring

1. Carlisle West (Walnut St)
2. Carlisle (Imperial Ct)

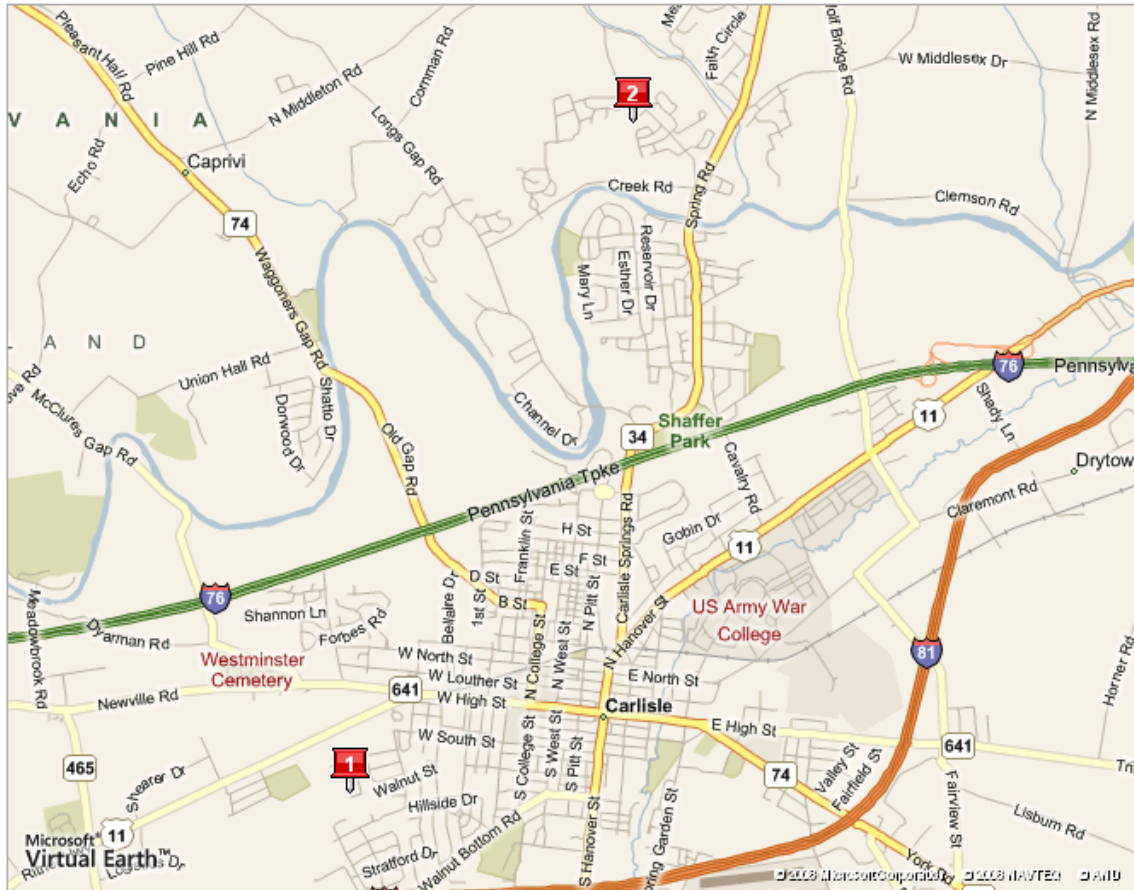


Figure 2 – Map of Carlisle Monitoring Sites (Imperial Court and Walnut Street)

PM_{2.5} Analyzers

The ambient air sampler used in this study was a Rupprecht & Patashnick, Partisol-Plus Model 2025 Sequential Air Sampler, manufactured by Thermo Fisher Scientific. This sampler is US EPA designated in the Federal Register (63 FR 18911, 4/16/1998) as a manual reference method for PM_{2.5} sampling, with a designation of RFPS-0498-118. Everyday sampling frequencies (24-hours, midnight to midnight) for both sites were maintained with filters collected by Bureau of Air Quality field personnel and analyzed by the Bureau of Laboratories personnel at their facility in Harrisburg.

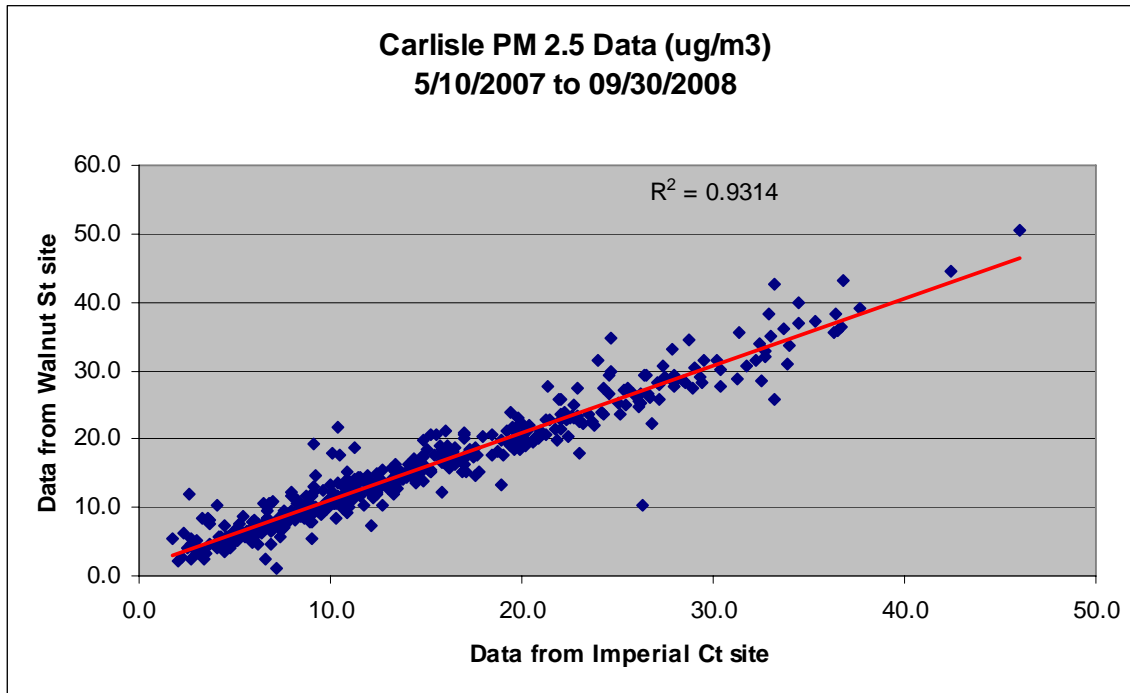
PM_{2.5} Study Results

The Department collected PM_{2.5} data from May 10, 2007 to September 30, 2008. The raw data is shown in Appendix A. The results of the analysis indicated that the special study Walnut Street site recorded higher concentrations than the Imperial Court site by 5%. The “yearly” average was obtained by averaging the quarterly averages. The averages that were calculated for the sites show that the Carlisle West (Walnut Street) site exceeded the annual PM_{2.5} NAAQS, but both sites exceed the 24-hour PM_{2.5} NAAQS based on the sampling. These averages, including those reported at the Harrisburg site, are shown in the following tables.

Site Name	Weighted Yearly Average	Arithmetic Mean	Quarterly Averages and Percent of Samples Valid					
			2 nd Qtr 2007	3 rd Qtr 2007	4 th Qtr 2007	1 st Qtr 2008	2 nd Qtr 2008	3 rd Qtr 2008
Carlisle (Imperial Ctr)	14.5	14.5	15.6	16.5	13.3	14.8	13.0	14.0
			54%	95%	86%	98%	97%	96%
Carlisle West (Walnut St)	15.3	15.2	16.2	16.4	14.7	16.6	13.8	14.2
			57%	82%	97%	92%	97%	99%
Harrisburg	14.9	14.8	16.7	16.7	13.7	15.4	13.1	13.8
			54%	92%	89%	96%	92%	99%

	Maximum 24-hour Values 2007-08				
	1 st	2 nd	3 rd	4 th	98 th Percentile
Carlisle (Imperial Ct)	46.0	43.5	42.4	37.7	35.3
Carlisle West (Walnut St)	50.5	44.5	43.2	42.5	36.9
Harrisburg	43.7	43.2	41.6	39.8	35.6

The data analysis found the data to be highly correlated. The following graph displays the linear relationship between the Imperial Court Site and the Walnut Street Site. The statistically calculated R^2 value of 0.9314 shows that the data sets are linearly correlated.



Statistical Comparison of the Annual Arithmetic Means of Imperial Court Site versus Walnut Street Site

To determine whether there is a statistical difference between the annual arithmetic means between these two separate monitoring sites in Carlisle, the T-test for comparing the actual arithmetic means of two independently distributed data sets was applied. The results from this T-test are shown below.

Sample Statistics Group	N (No of observations)	Mean	Standard Deviation	Standard Error
Imperial	449	14.45657	8.6368	0.4076
Walnut	449	15.42494	8.8192	0.4162

N provides non-missing observations for each site.
 Mean is the arithmetic mean.
 Standard Deviation measures how much the data deviates from its average value
 Standard Error is a standard deviation of the Means.

Table 1. Descriptive Statistical Analysis of Imperial Court Site and Walnut Street Site Data

One Tailed T-Test

If Variances Are	T statistic	Degree of freedom	Probability > t
Equal	-1.662	896	0.0968
Not Equal	-1.662	895.61	0.0968

Table 2. Statistical Comparison of Population Means of Imperial versus Walnut Streets

Equal variance results use the T-test formula where the analysis considers that Imperial and Walnut Street variances are equal.

Not Equal variance uses another T-test formula where the analysis considers that Imperial and Walnut Street variances are not equal.

Degree of freedom is applied to calculate t-statistic and P value

Variances: Measure of variability

T-Statistic: Calculated t--value using Statistical test formula for comparing two population means using small set of randomly selected data (with the assumption that these data have come from Normally distributed (Bell-Shaped) populations).

Pr>t: The calculated p-value based on calculated t-statistic (to compare with the significance levels)

Statistical Analysis Discussion:

Data Set 1 = Imperial Court Site

Data Set 2 = Walnut Street Site

The Null Hypothesis explains that there exists no difference between means of Imperial Court Site and Walnut Street Site. (Mean 1 = Mean 2)

The Alternative Hypothesis indicates that the Walnut Street mean is greater than Imperial court Site mean. (Mean 2 – Mean 1 > 0)

Only non-missing pairs of data were used. If on a particular day, one data point was missing from either of the sites, then that pair of data was not included in these T-tests.

The assumption here is that both data sets have come from normally distributed population groups. We will consider 5% error. This is also called the significance level. Therefore the significant level is 5% or 0.05. Significance level (Type I error) is the probability of rejecting the Null hypothesis, when it is true.

The calculated p value is 0.096.

This is greater than >.05, which implies that we do not reject the above established null hypothesis, which statistically concludes that there exists no difference between the Walnut Street and Imperial Court sites.

Conclusion

At the conclusion of the PM_{2.5} monitoring study at the Carlisle West (Walnut Street) site, several factors are notable:

1. Data between the Imperial court site and Walnut Street Site are highly correlated.
2. Comparing the annual means, the data at the Walnut Street site is approximately 5 percent higher than the Imperial Court site.
3. Data at the Walnut Street site is 7 to 11 percent higher in the fourth and first quarters of the year. During the second and third quarters, the data at Walnut Street is only 0 to 4 percent higher than the Imperial Court site. The higher differences seen in the late fall and winter period may indicate a seasonal localized effect due to truck idling or wood smoke from the local residences.
4. The T-test analysis concludes that there exists no significant difference between the annual arithmetic means of the Imperial Court and Walnut Street sites.

Appendices

Appendix A: Raw Data from Imperial Court and Walnut Street Sites

Table 1 – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
5/10/2007	10.6	11.7	Walnut St. site started on May 10th, 2007
5/11/2007	10.2	11.9	
5/12/2007	13.8	14.5	
5/13/2007	3.4	2.5	
5/14/2007	6.8	7.6	
5/15/2007	19.7	20.8	
5/16/2007	18.7	18.2	
5/17/2007	5.4	6.2	
5/18/2007	5.6	6.0	
5/19/2007	6.9	6.5	
5/20/2007	14.4	14.2	
5/21/2007	4.7	5.4	
5/22/2007	10.9	11.7	
5/23/2007	14.1	16.2	
5/24/2007	15.0	18.5	
5/25/2007	30.2	31.6	
5/26/2007	29.5	31.6	
5/27/2007	26.6	26.7	
5/28/2007	21.8	19.8	
5/29/2007	6.9	10.7	
5/30/2007	10.8	12.0	
5/31/2007	21.3	20.5	
6/1/2007	31.7	30.6	
6/2/2007	36.3	35.5	
6/3/2007	17.6	14.7	
6/4/2007	10.4	21.6	
6/5/2007		9.2	Sampling Instrument Error
6/6/2007		11.4	Sampling Instrument Error
6/7/2007		22.1	Sampling Instrument Error
6/8/2007	22.7	23	
6/9/2007	7.8	8.1	
6/10/2007	11.7	13.9	
6/11/2007	10.8	11.9	
6/12/2007	9	9.7	
6/13/2007	9.8	9.9	
6/14/2007	7.8	8.9	
6/15/2007	10.1	12.2	

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Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
6/16/2007	11.6	11.8	
6/17/2007	24.3	23.7	
6/18/2007	24.7	34.8	
6/19/2007	33.2	25.9	
6/20/2007	6.7	9.4	
6/21/2007	8.6	8.5	
6/22/2007	4.1	4.4	
6/23/2007	5.8	5.5	
6/24/2007	9.5	9	
6/25/2007	27.2	25.9	
6/26/2007	31.3	28.9	
6/27/2007	34	33.7	
6/28/2007	22.9	23.4	
6/29/2007	15.8	16.6	
6/30/2007	12.5	14.2	
7/1/2007	4.5	4.9	
7/2/2007	3	3.3	
7/3/2007	12.1	7.4	
7/4/2007	19.8	19.7	
7/5/2007	13.4	13.9	
7/6/2007	15.1	15.6	
7/7/2007	25.1	23.5	
7/8/2007	26.1	24.7	
7/9/2007	28	27.6	
7/10/2007	36.4	38.4	
7/11/2007	18.4	17.6	
7/12/2007	9.2	10	
7/13/2007	12.7	13.2	
7/14/2007	14.7	14.8	
7/15/2007	20.7	20.2	
7/16/2007	17	16.4	
7/17/2007	12.4	14.9	
7/18/2007	21.4	27.7	
7/19/2007	21	21.2	
7/20/2007	3.7	7.5	
7/21/2007		4	Filter Exchange Error
7/22/2007		5	Filter Exchange Error
7/23/2007		8.2	Filter Exchange Error
7/24/2007	11.9	14.6	
7/25/2007		14.7	Sampling Instrument Error
7/26/2007	22.6	23.3	
7/27/2007	16.2	15.8	
7/28/2007	29.3	29	
7/29/2007	26.8	22.2	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
7/30/2007	20.2	19.7	
7/31/2007	14.6	15.4	
8/1/2007	16.4	17.9	
8/2/2007	22.7	24.9	
8/3/2007	36.5	35.9	
8/4/2007	22	22.9	
8/5/2007	14.4	16.7	
8/6/2007	37.7	39.2	
8/7/2007	43.5		Filter Exchange Error
8/8/2007	26.5	29.3	
8/9/2007	11.6	14.4	
8/10/2007	8.4	10.1	
8/11/2007	4.4	5	
8/12/2007	7.6	7.1	
8/13/2007	16.9	15.3	
8/14/2007	4.8	4	
8/15/2007	17	21	
8/16/2007	25.4	25.1	
8/17/2007	26.7	26	
8/18/2007	2.2	2.7	
8/19/2007	6.4	6.2	
8/20/2007	8	12.1	
8/21/2007		4.7	Unknown at this time
8/22/2007	17.5	17.5	
8/23/2007	23.7	22.4	
8/24/2007	32.2	31.6	
8/25/2007	24.6	26.6	
8/26/2007	8.9	7.9	
8/27/2007	10.2	10.9	
8/28/2007	19.6	18.4	
8/29/2007	24.4		Filter Exchange Error
8/30/2007	24.5		Filter Exchange Error
8/31/2007	7.3		Filter Exchange Error
9/1/2007	3.2		Filter Exchange Error
9/2/2007	9.2		Filter Exchange Error
9/3/2007	22.4		Filter Exchange Error
9/4/2007	13.1		Filter Exchange Error
9/5/2007	21.5	22.7	
9/6/2007	29.1		Filter Exchange Error
9/7/2007	22.9		Filter Exchange Error
9/8/2007	24.9		Filter Exchange Error
9/9/2007	12.9		Filter Exchange Error
9/10/2007	16.2		Filter Exchange Error
9/11/2007	10.6		Filter Exchange Error

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Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
9/12/2007	4.9	4.6	
9/13/2007	14.3		Operator Error - Wrong Start Date
9/14/2007	15.4	17.6	
9/15/2007	4.1	5	
9/16/2007	2.9	3.9	
9/17/2007	8	11.8	
9/18/2007	9.2	14.6	
9/19/2007	9.6	12.5	
9/20/2007	16.1	19.1	
9/21/2007	16.2	17.4	
9/22/2007	17.5	18	
9/23/2007	9	11.8	
9/24/2007	7.8		Sampling Instrument Error
9/25/2007	19.3		Sampling Instrument Error
9/26/2007	26.4	29.3	
9/27/2007	21.3	22.7	
9/28/2007	7.7	8.1	
9/29/2007	3.6	8.5	
9/30/2007	10.6	10.4	
10/1/2007	10	11.5	
10/2/2007	7.7		Sampling Instrument Error
10/3/2007	9.1		Sampling Instrument Error
10/4/2007	15.2	15.1	
10/5/2007	20.6	19.5	
10/6/2007	17.6	18.8	
10/7/2007	11.7	13.8	
10/8/2007	18.4	20.6	
10/9/2007	25.3	27.2	
10/10/2007	10.4	11.7	
10/11/2007	4.1	4.5	
10/12/2007	3.2	3.7	
10/13/2007	6.4	7	
10/14/2007	8.7	8.9	
10/15/2007	11	13	
10/16/2007	14.4	17.1	
10/17/2007	28	29.4	
10/18/2007		21.5	Unknown at this time
10/19/2007	9.7	9.7	
10/20/2007	6.5	7.4	
10/21/2007	7.6	9.2	
10/22/2007	12.2	13.2	
10/23/2007	10.7	11.2	
10/24/2007	3.5	3.3	
10/25/2007	4.8	4.7	

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 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
10/26/2007	5.1	5.9	
10/27/2007	5.5	5.7	
10/28/2007	2.9	4.1	
10/29/2007	6.2	7.7	
10/30/2007	13.8	14.2	
10/31/2007	16.4	18.2	
11/1/2007	8.1	8.9	
11/2/2007	4.5	7.4	
11/3/2007	4.9	6.3	
11/4/2007	11.2	13	
11/5/2007	10.8	12	
11/6/2007	5.1	6	
11/7/2007	4.1	4.7	
11/8/2007	10.4	13.6	
11/9/2007	22.4	23.1	
11/10/2007	17	20.2	
11/11/2007	13.2	15.7	
11/12/2007	30.4	30.2	
11/13/2007	15.8	17.8	
11/14/2007	27.2	28	
11/15/2007	8.4	8.8	
11/16/2007	3	3.9	
11/17/2007	15.9	17	
11/18/2007	14.9	17.3	
11/19/2007	11.5	14.4	
11/20/2007	26.2	26.6	
11/21/2007	35.3	37.2	
11/22/2007		16.7	Filter Exchange Error
11/23/2007		2.6	Filter Exchange Error
11/24/2007		9.8	Filter Exchange Error
11/25/2007		16.7	Filter Exchange Error
11/26/2007		19.8	Filter Exchange Error
11/27/2007	6.8	7.2	
11/28/2007	5.4	6	
11/29/2007	9	7.8	
11/30/2007	10.2	10.7	
12/1/2007	5.1	5.2	
12/2/2007	13.4	13.3	
12/3/2007	7.3	8.4	
12/4/2007	2	2.3	
12/5/2007	10.9	13.2	
12/6/2007	12.7	13.5	
12/7/2007	24	31.6	
12/8/2007	33.2	42.5	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
12/9/2007	31.4	35.7	
12/10/2007	22	25.7	
12/11/2007	19.5	21.7	
12/12/2007		9	Filter Exchange Error
12/13/2007		10.4	Filter Exchange Error
12/14/2007	16.4	17.1	
12/15/2007	10.3	8.5	
12/16/2007	5.5	6.2	
12/17/2007	4.2	5.8	
12/18/2007		19.7	Filter Exchange Error
12/19/2007		19.3	Filter Exchange Error
12/20/2007		20.4	Filter Exchange Error
12/21/2007	27.4	30.6	
12/22/2007	26.1	25.6	
12/23/2007		11.2	Filter Exchange Error
12/24/2007		4.2	Electrical Problem w/Sampler - Fixed
12/25/2007	10.5	17.7	
12/26/2007	22.9		Unknown at this time
12/27/2007	29	30.3	
12/28/2007	17	20.6	
12/29/2007	10	13.3	
12/30/2007	19.7	21.8	
12/31/2007	15.5	20.7	
1/1/2008	14.5	16.1	
1/2/2008	7.9		Filter Exchange Error
1/3/2008	7.4	5.6	
1/4/2008	20.3	21.2	
1/5/2008	25.5	27.5	
1/6/2008	32.4	33.9	
1/7/2008	28.7	34.5	
1/8/2008	19.4	23.9	
1/9/2008		5.4	Filter Exchange Error
1/10/2008		11.8	Filter Exchange Error
1/11/2008	8.7	9.3	
1/12/2008	14.9	19.9	
1/13/2008	23.5	23.5	
1/14/2008	11.4	13.5	
1/15/2008	11.7	10.4	
1/16/2008	10.9	14.2	
1/17/2008	22.2	23.9	
1/18/2008	13.5	15.1	
1/19/2008	12	12.5	
1/20/2008	7.8	8.6	
1/21/2008	10		Filter Exchange Error

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Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
1/22/2008	16.5	18.8	
1/23/2008	9	10.3	
1/24/2008	16.4	17.3	
1/25/2008	7.7	8.6	
1/26/2008	18.9	19.9	
1/27/2008	24.7	29.8	
1/28/2008	22.9	27.4	
1/29/2008	42.4	44.5	
1/30/2008	4.1	10.3	
1/31/2008	26.3	10.2	
2/1/2008	5		Filter Exchange Error
2/2/2008	15.7	19	
2/3/2008	27.9	33.2	
2/4/2008	34.5	36.9	
2/5/2008	36.8	43.2	
2/6/2008	13.4	16.2	
2/7/2008	6.2	4.7	
2/8/2008	12.7	15.5	
2/9/2008	33.7	36.2	
2/10/2008	5.6	6.6	
2/11/2008	8.1		Filter Exchange Error
2/12/2008	19.7		Filter Exchange Error
2/13/2008	11.3	14.2	
2/14/2008	13.2	14	
2/15/2008	24.6	29.4	
2/16/2008	12.7	13.9	
2/17/2008	19.5	19	
2/18/2008	8.5	9.7	
2/19/2008	5	5.2	
2/20/2008	9.3	9.6	
2/21/2008	8	9.5	
2/22/2008	20.9	20	
2/23/2008	19.6	19.6	
2/24/2008	20.4	21.9	
2/25/2008	32.9	38.4	
2/26/2008	34.5	39.8	
2/27/2008	5.2	5.6	
2/28/2008	3	5.2	
2/29/2008	17.1	15.1	
3/1/2008	2.6	11.9	
3/2/2008	3.7	8.2	
3/3/2008	10.1	11.5	
3/4/2008	10.9	15.2	
3/5/2008	6.2	6.5	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
3/6/2008	17.2	18	
3/7/2008	24.3	27.5	
3/8/2008	6.7	8.5	
3/9/2008	5.9		Sampler blew over in storm
3/10/2008	16.9		Sampler blew over in storm
3/11/2008	21.9	25.7	
3/12/2008	16.5	16.2	
3/13/2008	15.2	15.2	
3/14/2008	24.2	23.8	
3/15/2008	11	12.3	
3/16/2008	8	9.1	
3/17/2008	2.7	4.5	
3/18/2008	10.7	13	
3/19/2008	19.4	19.1	
3/20/2008	4.6	4.6	
3/21/2008	4.1	4	
3/22/2008	4.3	5.4	
3/23/2008	4.3	4.5	
3/24/2008	7	10.8	
3/25/2008	8.7	11.7	
3/26/2008	12	13	
3/27/2008	19.2	21.3	
3/28/2008	20.1	20.6	
3/29/2008	5.8	5.5	
3/30/2008	6.9	7.7	
3/31/2008	8.4	9.2	
4/1/2008	6.9	4.5	
4/2/2008	5.4	8.8	
4/3/2008	9.1	19.4	
4/4/2008	12.1	11.9	
4/5/2008	10.2	11.2	
4/6/2008	10.2	10.7	
4/7/2008	23	17.8	
4/8/2008	18.9	13.3	
4/9/2008	23.2	22.2	
4/10/2008	12	12.6	
4/11/2008	18	20.4	
4/12/2008	7.5	7.7	
4/13/2008	4.3	5.6	
4/14/2008	2.7	5.5	
4/15/2008	11.4	13.9	
4/16/2008	10.1	17.9	
4/17/2008	11.3	18.8	
4/18/2008	20.1	22.1	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
4/19/2008	25	25.3	
4/20/2008	17.3	18.3	
4/21/2008	9.1	13	
4/22/2008	10.7	9.7	
4/23/2008	10.4	10.9	
4/24/2008	8.3	11	
4/25/2008	16.5	17.3	
4/26/2008	28.9	27.5	
4/27/2008	15.8	18.4	
4/28/2008	6.6		Transport Error
4/29/2008	5.7	6.5	
4/30/2008	11.6	12.2	
5/1/2008	19.7		Transport Error
5/2/2008	36.7	36.5	
5/3/2008	46	50.5	
5/4/2008	8.7	10.7	
5/5/2008	6.7	8.4	
5/6/2008	14.5	15	
5/7/2008	19.3	19.3	
5/8/2008	13	12.7	
5/9/2008	5.4	6	
5/10/2008	4.6	5.7	
5/11/2008	7.6	7.2	
5/12/2008	3.4	3.4	
5/13/2008	4.6	5.3	
5/14/2008	9.2	9.4	
5/15/2008	9.1	9.9	
5/16/2008	2.7	2.4	
5/17/2008	8.2	8.8	
5/18/2008	3.3	8.5	
5/19/2008	6.2		Filter Exchange Error
5/20/2008	9.7	10.7	
5/21/2008	9	5.5	
5/22/2008	4.5	3.6	
5/23/2008	3.2	3.6	
5/24/2008	2.5	4	
5/25/2008	4.7	5.8	
5/26/2008	14.7	15.4	
5/27/2008	15.8	16.7	
5/28/2008	3.3	3	
5/29/2008	6	8.1	
5/30/2008	14.9	13.8	
5/31/2008	16.4	17.1	
6/1/2008	7.6	9.6	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
6/2/2008	7.5	6.9	
6/3/2008	14.8	15.4	
6/4/2008	12.4	12.1	
6/5/2008	15.9	16.6	
6/6/2008	27.5	29	
6/7/2008	27.1	28.1	
6/8/2008	19.8	23.1	
6/9/2008	16	21.1	
6/10/2008	15.2	20.5	
6/11/2008	8.2	8.2	
6/12/2008	12.7	13.3	
6/13/2008	33	35	
6/14/2008	29.4	28.1	
6/15/2008	11.2	11.1	
6/16/2008	14	14.3	
6/17/2008		7.5	Calibration/Maintenance Down Time
6/18/2008		7.8	Calibration/Maintenance Down Time
6/19/2008	11	10.1	
6/20/2008	17.8	15.3	
6/21/2008	17	17	
6/22/2008	13.5	12.7	
6/23/2008	12.4	11.9	
6/24/2008	7.9	8.2	
6/25/2008	17.7	17.6	
6/26/2008	23	22.4	
6/27/2008	11.9	14.5	
6/28/2008	14.2	15.8	
6/29/2008	7	7.6	
6/30/2008		12.5	Filter Exchange Error
7/1/2008		7.5	Filter Exchange Error
7/2/2008	12.5	13	
7/3/2008	15.2	15.6	
7/4/2008	13.4	15.3	
7/5/2008	21.7	21.5	
7/6/2008	25.8	26.6	
7/7/2008	16.7	16.8	
7/8/2008	20.1	20.8	
7/9/2008	17	16.2	
7/10/2008	9.6	10	
7/11/2008	19.9	18.4	
7/12/2008	32.7	32.1	
7/13/2008		18.4	Filter Exchange Error
7/14/2008		11.4	Filter Exchange Error
7/15/2008		16.4	Filter Exchange Error

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Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
7/16/2008	22.5	23	
7/17/2008	28.4	28.4	
7/18/2008	33.9	31	
7/19/2008	32.5	28.4	
7/20/2008	30.4	27.8	
7/21/2008	23.8	22	
7/22/2008	14.5	13.5	
7/23/2008	7.4	6.8	
7/24/2008	7.6	7.4	
7/25/2008	14.6	14	
7/26/2008	20	19.6	
7/27/2008	20.2	19.1	
7/28/2008	28.5	28.3	
7/29/2008	28	28.3	
7/30/2008	28	28.7	
7/31/2008	22	21.5	
8/1/2008	14.2	15.4	
8/2/2008	19	17.6	
8/3/2008	6.7	7.5	
8/4/2008	10.9	9.2	
8/5/2008	26.2	25.3	
8/6/2008	15.8	12.2	
8/7/2008	9.6	9.8	
8/8/2008	5.9	4.9	
8/9/2008	5.1	7	
8/10/2008	14.8	17.3	
8/11/2008	9	9	
8/12/2008	7.4	7.1	
8/13/2008	13.7	15.3	
8/14/2008	12.1	13	
8/15/2008	11.1	11.6	
8/16/2008	8.5	8.7	
8/17/2008	12.3	13.3	
8/18/2008	20.7	19.8	
8/19/2008	13.8	14.8	
8/20/2008	2.3	6.3	
8/21/2008	12.2	13.1	
8/22/2008	14.6	15.9	
8/23/2008	12.2	11.5	
8/24/2008	9.1	9.7	
8/25/2008	9.6	9.9	
8/26/2008	3.2	3.3	
8/27/2008	6.5	6.8	
8/28/2008	7.5	7.2	

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**Table 1 (continued) – PM_{2.5} Concentration at each of the Carlisle monitoring sites
 (Units: micrograms per cubic meter)**

Date	Imperial Ct (Carlisle Springs)	Walnut St (Exit 44)	Remarks
8/29/2008	7	6.9	
8/30/2008	22	23.5	
8/31/2008	6.8	10.7	
9/1/2008	7.7	8.4	
9/2/2008	5.9	7.8	
9/3/2008	14.5	15.2	
9/4/2008	32.7	32.9	
9/5/2008	20.7	20.2	
9/6/2008	7.7	7.5	
9/7/2008	10.9	10	
9/8/2008	22.4	20.4	
9/9/2008	12.7	10.4	
9/10/2008	4.5	4.5	
9/11/2008	6.6	2.4	
9/12/2008	7.2	1.2	
9/13/2008	10.7	10.2	
9/14/2008	13.3	12	
9/15/2008	2.5		Filter Exchange Error
9/16/2008	6.1	6.8	
9/17/2008	10.3	10.7	
9/18/2008	8.3	10.6	
9/19/2008	6.7	8.1	
9/20/2008	9.1	12.1	
9/21/2008	17.3	18.4	
9/22/2008	22.3	22.9	
9/23/2008	11.5	13.7	
9/24/2008	6.5	10.5	
9/25/2008	5.2	7.6	
9/26/2008	2.9	4	
9/27/2008	3.7	4.6	
9/28/2008	1.7	5.5	
9/29/2008	6.1	6	
9/30/2008	14.9	16.3	