South Coast Air Quality Management District
Monitoring and Analysis

Rule 1158 Follow-Up Study #1

Sampling Conducted
November and December, 1999

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EXECUTIVE SUMMARY

Purpose

In June 1999, Rule 1158 affecting storage, handling and shipment of petroleum coke, coal, and sulfur was amended to further reduce particulate emissions from these sources. The current study was implemented to generate data reflecting the amount of targeted compounds contained in the inhalable particulate fraction (PM_{10}) in the greater Long Beach/Wilmington Area. Results generated by this study were compared to results obtained during the identical time frame in 1998, which were reported in the study *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors* (March 1999).

Sampling

Sampling was conducted coincident with the AQMD PM_{10} monitoring network one-in-six day schedule from November 2, 1999 to December 14, 1999. Sampling location selections were the three most relevant sites from the 1998 study, based primarily on ambient PM_{10} and elemental carbon concentrations. Field operations were contracted to RES Enviornmental, Inc. (Colton, CA), while all laboratory operations and data analysis were performed by AQMD personnel. Twenty-three samples were collected over eight non-consecutive sampling days.

Key Findings

1. Ambient PM_{10} concentrations continued to be among the highest measured in the basin, with increases seen above the 1998 study. PM_{10} concentrations were consistently higher at the study sites than at the nearby Long Beach PM_{10} network monitoring site.

2. The average carbonaceous contribution to PM_{10} decreased from the 1998 study to the 1999 study.

3. The average contribution of elemental carbon to the carbonaceous fraction decreased from the 1998 study to the 1999 study, as evidenced by a decrease in the calculated elemental-to-organic carbon ratio.

1.0 INTRODUCTION

From November 2, 1999 to December 14, 1999, PM_{10} monitoring was conducted at three locations in the cities of Long Beach (two sites) and Wilmington (one site). This study constituted the first of multiple studies evaluating improvements in local air quality precipitated by implementation of Rule 1158, as amended on June 11, 1999. The next sampling event is slated to begin in May 2000.

This study builds on a base of knowledge established by two previous studies: *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors* (September 1997) and (March 1999). The primary objectives of the current study were to collect data suitable for the evaluation of:

> Current inhalable particulate (PM_{10}) ambient concentration trends for the study area.
>
> Speciation of the carbonaceous component of the collected particulate samples for elemental carbon content.
>
> Comparison of 1999 concentration and carbon data with that obtained during an analogous time frame in the 1998 study.

The prevailing meteorological trends in the study area place portions of the community downwind of coal and coke production and/or storage facilities, and fugitive dust from these activities has been a longstanding community concern. This fugitive dust contributes to increases in the ambient inhalable (PM_{10}) particulate concentration. Mobile sources such as diesel trucks, trains and ships in the area also contribute to the overall ambient particulate matter concentrations.

The June 1999 amendment of Rule 1158 affected storage, handling and shipment practices for petroleum coke, coal, and sulfur. Removal of open coke storage piles, and modification to equipment and work practices to comply with Rule 1158 requirements is ongoing. The Rule 1158 compliance schedule mandates implementation of the majority of control measures by August 1999, with full implementation of all measures by June 2004. It is anticipated that full implementation of Rule 1158 will contribute to a decrease in ambient PM_{10} concentrations in the local area.

2.0 BACKGROUND

Samples were scheduled for collection at three sites over seven different days, producing a potential data set consisting of twenty-one samples (ultimately twenty-three samples were collected). Site selection and the sampling calendar were influenced by several factors.

All three sites in the current study were included in the 1998 study. In order to maximize the applicability of the results to the community at large, the three sites retained included two schools and the child care center from the previous study. In addition, of the seven sites included in the 1998 study, the two school sites had exhibited the highest levels of ambient PM_{10} and elemental carbon.

The sampling was scheduled to coincide with the EPA one-in-six monitoring schedule utilized by the AQMD in its PM_{10} monitoring network. Consequently, the results obtained by the project can be compared to network results from Long Beach as well as locations distributed throughout the basin.

3.0 TOPOGRAPHY AND CLIMATOLOGY

Micrometeorological studies were not conducted in conjunction with this study. Data from 1997 and 1998 studies indicates daytime prevailing winds originate from a westerly and southwesterly direction. Wind measurements taken at the Long Beach monitoring station (3648 N. Long Beach Blvd.) during the current study period indicate a diurnal pattern of nighttime and early morning northerlies, and daytime winds from the southwest. The most marked deviation from this pattern occurred on December 14, 1999, where winds for the 24-hour period were almost uniformly northerly due to Santa Ana conditions. Weather conditions for the study period were unseasonably dry, with December rainfall being below the historical average.

Historical topographical and climatological conditions for the study area were extensively examined in the 1998 study, and are reproduced here[1].

3.1 TOPOGRAPHY

The harbor areas of San Pedro, Wilmington, Los Angeles and Long Beach are part of the relatively flat coastal plane. This plane averages 20 feet above mean sea level (msl) at all AQMD sampling sites except at one site in San Pedro which is approximately 120 feet above msl. San Pedro is situated in the eastern foothills of the Palos Verdes Peninsula. The peninsula rises gradually from the coast to approximately 300 feet above msl. To the west and north of San Pedro, the Palos Verdes Hills reach elevations exceeding 1,000 feet above msl. Industrial businesses command the San Pedro coastline while the city becomes increasingly residential as the foothills rise in elevation. Los Angeles Harbor and Wilmington are heavily industrialized with small pockets of residential areas dispersed throughout. Long Beach is a mixture of heavy industry close to the coastline and a mix of industry and residential neighborhoods further inland.

[1] South Coast Air Quality Management District. (1999). *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.

3.2 CLIMATOLOGY

3.21 GENERAL

Autumn is one of the most stagnant weather periods in the District. Synoptic-scale weather systems are still too weak to produce cloudy, rainy and cold weather. Sea breezes are weakened, and high-pressure systems that build up over the interior deserts counteract the sea breezes to create stagnation. Occasionally, the clockwise circulation around these high-pressure systems produces an intense drying east wind, known locally as a Santa Ana. These winds may last only a few hours or may persist several days throughout the Basin. Because the greatest frequency of stagnant conditions occurs during the autumn, the highest levels of particulate normally occur during this period as well. Without the "cleansing" mechanism of the Santa Ana winds sweeping through the Basin, moisture and pollutant emissions react to form new particles. These particles, coupled with directly emitted particles, lead to elevated PM_{10} levels.

3.22 LOCAL WIND FLOWS

The "Catalina Eddy" is a low-level cyclonic flow centered over Santa Catalina Island. Although the Catalina Eddy is most prevalent during the spring and summer months, it influences coastal areas to a larger extent than Santa Ana winds. During fall and winter months, the eddy forms ahead of a cold front and causes Basin coastal winds back toward the southeast.

Winds recorded at Los Angeles Harbor indicate that the predominant flow is westerly throughout the year. Southerly winds occurring over Terminal Island are predominately due to the influence of friction caused by light morning westerlies diverted around the Palos Verdes Peninsula. As the wind speed increases during the day, friction becomes less influential in the Los Angeles Harbor area. North and northeasterly winds are typically present in the evening hours due to drainage flow down the flat coastal plane east of the Palos Verdes Peninsula towards the sea.

3.23 TEMPERATURE AND PRECIPITATION

Temperatures in October and November are generally mild and seasonal decreases in effective radiational warming begin to offset the warmer summer weather. Warming in land-locked valleys occurs noticeably quicker than in southern parts of the District. This warming is moderated by a higher than average percentage of cloud cover. Temperatures in the San Pedro, Wilmington, and Long Beach areas correspond closely with the San Pedro climatological data. The average maximum temperatures in San Pedro in October, November, and December are 71, 68, and 65 degrees Fahrenheit, respectively. The average minimum temperatures for October, November, and December are 57, 53, and 50 degrees Fahrenheit, respectively. Precipitation averages 0.27 inches in October, 0.97 inches in November, and 2.02 inches in December.

4.0 EQUIPMENT LOCATION, DESCRIPTION, AND COLLECTION METHODOLOGY

Three monitoring sites were chosen based upon their location relative to coal and coke facilities with respect to the local prevailing wind patterns, their PM_{10} concentration rankings within the 1998 study, and their importance as locations containing student populations. (See Figure 1.)

Site 1: School Building Services Facilities/Hudson School (HUD)
2401 Webster Avenue
Long Beach, California

Site 2: Edison Elementary School (EDI)
625 Maine Avenue
Long Beach, California

Site 3: Wilmington Childcare Center (WIL)
1419 Young Street
Wilmington, California

RES Environmental, Inc. (RES), was contracted by the AQMD to perform field operations for the current study. The consultant described the sampling locations as follows[2]:

- **PM_{10} Monitoring Site #1 (HUD)**
  The monitoring site is located at the Long Beach School Building Services facility (maintenance yard), adjacent to the Hudson Middle School. The PM_{10} sampler was installed on top of two adjoining steel containers. Meteorological exposures were composed of (1), Henry Ford Freeway, which runs parallel to the monitoring site to the west and (2), maintenance yard to the north, east and south of the monitoring site. The maintenance yard consists of repairs and fabrication of materials, including welding. Vehicle traffic ranges from light during most of the day to moderate at the beginning and ending of each day, Monday through Friday.

- **PM_{10} Monitoring Site #2 (EDI)**
  Site #2 was located at the Edison Elementary School in Long Beach. The PM_{10} sampler was located on a steel container at the western side of the school and playground. The sampler was also installed on a five-foot platform to clear the school building to the east. The meteorological exposure consists of (1), a main street artery (16^{th} Street) which carries

[2] RES Environmental, Inc. (2000) *The South Coast Air Quality Management District – Follow up to the Rule 1158 PM-10 Monitoring Study.* Colton, CA.

heavy vehicle traffic, is located to the north (2), school buildings to the east and south and (3), a small bus terminal to the west of the monitoring site.

- **PM_{10} Monitoring Site #3 (WIL)**
  The monitoring site was installed on the roof of the Childcare Center, near a elementary and middle school in the City of Wilmington. The meteorological exposure consists of (1), a residential area to the north (2), commercial/industrial development to the east (3), school to the south and (4) parking area/residential area to the west of the monitoring site. Moderate vehicle traffic was observed during the morning and afternoon hours in the parking areas when school personnel are parking and leaving and during time periods when children are being released and picked-up at the Wilmington Childcare Center.

RES equipped each site with PM_{10} particulate monitoring samplers, and conducted a calibration regimen as follows[3]:

> A total of three (3) PM-10 particulate samplers were used for the SCAQMD PM-10 monitoring program. All samples were collected from Anderson/General Metal Works, Inc., Model G1200, SSI HV PM-10 samplers, RFPS-1287-063. The Model G1200, PM-10 samplers meets all EPA performance specifications, using a combined flow controller, mechanical/electronic timer, and model 305-105 pressure transducer flow recorders…
>
> A Sierra Anderson Model G28, variable resistance high volume calibrator was used to perform two 5-point calibrations on the three PM-10 particulate samplers. These calibrations determined a set point flow that were used to maintain a flow rate of 40 (PM-10) standard cubic foot per minute (SCFM) at standard conditions of temperature and pressure. The G28 calibrator adjusts air flows from 15-50 SCFM, permitting calibration of the flow indicator at various points on the manometer. The calibrator composes of variable resistance orifice assembly, NBS traceable calibration curve and manometer. A 5-point calibration was performed on all samplers at the site prior to and during the monitoring study. The second calibration was performed to insure that the calibration set point has (*sic*) not changed.

The study period was initially slated for six non-consecutive sampling events, and was subsequently increased to seven so that each day of the week was represented by a sample. As a result of a power failure at the WIL site on during the seventh sampling event, an eighth sampling was conducted at all three sites. The resulting 23 samples comprise the current study.

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[3] Ibid.

The sampling dates were November 2, 8, 14, 20, and 26, December 2, 8, and 14, 1999. During the monitoring cycle, filters and accompanying reports were released to and received from RES. At all times, strict sample custody procedures were followed. Each sample was identified using a unique filter identification number, and was accompanied by a chain of custody document recording sample event information, consultant and AQMD staff custody signatures, and sample ID number.

5.0 ANALYTICAL METHODS

The PM_{10} sample filters were conditioned and weighed before distribution to the consultant for field sampling. After sampling, the filters were returned with their custody reports reflecting sampling time, conditions, and flow measurements to the AQMD laboratory for analysis. Using the recorded flow information, total sampled air volumes were calculated.

Once at the AQMD, the filters were conditioned, weighed to obtain the total mass of PM_{10} collected, and were used to perform carbon analysis.

6.0 DATA ANALYSIS

Data from the current study was compared with data obtained in the 1998 study. For appropriate comparison to previous results, only data collected during November and December of 1998 was utilized – October 1998 data was omitted.

6.1 PM_{10} AMBIENT CONCENTRATION ANALYSIS

Table 1
PM_{10} Concentrations at Sampling Sites

	Date								
Site	**11/2/99**	**11/8/99**	**11/14/99**	**11/20/99**	**11/26/99**	**12/2/99**	**12/8/99**	**12/14/99****	**Average**
HUD	92	38	50	30	47	69	68	171	71
EDI	85	33	47	37	49	74	93	97	64
WIL	92	89	46	30	65	70	*	87	68
Max/day	92	89	50	37	65	74	93	171	

Concentrations in $\mu g/m^3$
* No sample for WIL 12/8 due to power failure
** Santa Ana wind day
Note: State PM_{10} standard = 50 $\mu g/m^3$; Federal standard = 150 $\mu g/m^3$

Twenty-four hour ambient PM_{10} concentrations during the study period ranged from a maximum of 171 $\mu g/m^3$ at HUD on December 14, to a minimum of 30 $\mu g/m^3$ obtained at both the HUD and WIL sites on November 20. The average concentration for the study was 67.8 $\mu g/m^3$. Ambient concentration data is summarized in Figures 2 and 3.

Table 2
Average PM_{10} Concentrations by Year and Site

AVERAGE PM_{10} CONCENTRATIONS		
SITE	1998 AVERAGE	1999 AVERAGE
HUD	67	71
EDI	61	64
WIL	50	68

Concentrations in $\mu g/m^3$

As Table 2 above illustrates, the 1999 average total ambient PM_{10} concentrations were observed to be higher than the values obtained for the same time period in 1998.

The State of California has established 50 $\mu g/m^3$ as the PM_{10} 24-hour standard. Thirteen of the twenty-three (57%) samples collected during the course of the study exceeded this standard. The highest site average (71 $\mu g/m^3$) over the course of the study occurred at the HUD site. This continues the trend observed in the 1997 and 1998 studies, where HUD was the site ranked with the highest PM_{10} concentration.

6.2 CARBON ANALYSIS

To determine the carbon content of the samples, a thermal-optical carbon analyzer was utilized. Using this technique, carbon contributions to PM_{10} can be speciated as organic carbon, generally arising from fuel combustion processes; and elemental carbon, partially arising from coke and coal storage and/or transportation. In areas comprised of a similar residential/industrial mix as the sites studied, typical ratios of elemental carbon to organic carbon are 0.5**:**1 to 0.3**:**1.

Table 3
Carbon Analysis Summary

Site	Average Mass ($\mu g/m^3$)	Organic Carbon Average ($\mu g/m^3$)	Elemental Carbon Average ($\mu g/m^3$)	Average % PM_{10} as Total Carbon	Average % PM_{10} as Elemental Carbon
HUD	71	10.4	7.2	26%	10%
EDI	64	9.5	5.0	23%	8%
WIL	68	10.2	5.6	24%	8%

As in the 1998 study, the total carbon content on the filters was compared to the total mass of PM_{10} collected on those filters. Carbonaceous materials accounted for 15%-36% by weight of the total PM_{10} collected, while in 1998 carbon comprised 18%-39% of PM_{10} mass. Again, the HUD site exhibited the highest total carbon and elemental carbon concentrations. A comparison of elemental carbon levels is shown in Figure 4.

Table 4
Comparison of 1998 and 1999 Carbon Results

Site	1998 Average % PM_{10} as Carbon	1999 Average % PM_{10} as Carbon	1998 Average % PM_{10} as Elemental Carbon	1999 Average % PM_{10} as Elemental Carbon
HUD	32%	26%	17%	10%
EDI	26%	23%	12%	8%
WIL	25%	24%	10%	8%

The ratios of elemental carbon to organic carbon for the current study are listed in Appendix A-3. Current results indicate ratios ranging from 0.8**:**1 to 0.4**:**1. The same sites yielded ratios of 1.4**:**1 to 0.6**:**1 in the 1998 study.

6.3 DISCUSSION OF SITE-SPECIFIC RESULTS

The results obtained in the present study may show evidence of trends suggesting a decrease in ambient elemental carbon concentrations. However, these trends are limited in magnitude when micrometeorolgical variability and experimental error are considered.

At the HUD site, PM_{10} and elemental carbon concentrations remained the highest among sites studied, as they had been in 1997 and 1998. The average PM_{10} mass for the HUD site during the current study (71$\mu g/m^3$) was slightly higher than that observed in 1998 (67 $\mu g/m^3$), however the 1999 value was somewhat elevated due to an uncharacteristically heavy sample loading on December 14.

While the PM_{10} concentrations remained comparable to that observed in the previous year, the observed contribution of total carbon to PM_{10} decreased from an average of 32% in 1998 to an average of 26% in 1999. Meanwhile, the composition of the carbonaceous fraction shifted toward a lower elemental carbon content, as evidenced by the decrease in the calculated elemental carbon to organic carbon ratios. At the HUD site in particular, a decrease in elemental carbon contributed to a greater decrease in the percentage of total carbon than was observed at the other sites.

An identical trend was observed for the EDI site, though the extent of the change was less pronounced. The average PM_{10} mass for the study was 64$\mu g/m^3$ as compared to 61$\mu g/m^3$ in 1998. The average contribution to PM_{10} by carbon was 23%, comparable to the value of 26% calculated in 1998. The average elemental carbon content of the 1999 samples was 8%, down from 12% in 1998.

A considerable change in average PM_{10} concentration occurred at the WIL site between 1998 and 1999, increasing from 50$\mu g/m^3$ to 68$\mu g/m^3$. It is interesting to note that in spite of this increase in total inhalable particulate, the final profile of the carbon fraction was analogous to that observed at the HUD site, and was accompanied by the aforementioned decrease in elemental carbon to organic carbon calculated ratio. Therefore, although the percentage of carbon as PM_{10} mass decreased at the WIL site, the average ambient elemental carbon concentration remained about the same as was observed in 1998.

Underscoring the spatial and micrometerological effects on PM_{10} concentration, we can compare the current study results to data obtained at the Long Beach PM_{10} network station. Figure 5 illustrates that the ambient PM_{10} concentration obtained by averaging the study sites exceeds the PM_{10} observed at the Long Beach network station on each of the sampling days. An identical observation was made during the 1998 study, and the conclusion made at that time was that " the AQMD's north Long Beach PM_{10} monitoring network site is not fully representative of the greater Long Beach/Wilmington area."[4] The current results reinforce this conclusion, and indicate the value of additional studies to evaluate the evolving impact of Rule 1158. Additionally, efforts are currently underway to relocate the Long Beach Air Monitoring Station to a more southerly location to better characterize local air quality.

6.4 BASIN WIDE RESULTS COMPARISON

Like the 1998 study, the current study was conducted coincidentally with District wide PM_{10} monitoring, in accordance with the EPA 1-in-6 day sampling schedule. Rubidoux is consistently the site with the highest measured PM_{10} concentration in the District. Figure 6 illustrates that Rubidoux was exceeded by the maximum project PM_{10} measurement on four of the eight days sampling was conducted. This is the same result as that obtained in the 1998 study. Further, on only two occasions during the current study was the project maximum surpassed by a site other that Rubidoux (Anaheim, November 20 and December 2).

[4] South Coast Air Quality Management District. (1999). *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.

7.0 CONCLUSIONS

The greater Long Beach/Wilmington area examined in this study continues to experience elevated PM_{10} levels, more characteristic of sites further inland. These elevations in inhalable particulate vary greatly on a local scale, as can be seen when comparing the results of this study with the nearby Long Beach PM_{10} network monitoring site. Only on two days, November 14 and 20, were all three study sites in compliance with state PM_{10} standards.

As micrometerorological measurements were not taken during this study, elevated PM_{10} concentrations cannot be assigned to specific sources. Wind data from the north Long Beach PM_{10} monitoring network was used as a general indicator that predominant wind patterns conformed to those observed in the 1997 and 1998 studies.

Although varying degrees of increase in PM_{10} concentration were observed between 1998 and 1999, the particulate population shows a trend of decreasing carbon content. Further, this decrease is more marked in the elemental carbon fraction, the fraction contributed primarily by coke/coal dust operations and diesel emissions. This conclusion is best illustrated by comparing the ratios of elemental to organic carbon in the PM_{10} samples. As the ratios decrease, the elemental carbon in the air decreases. In 1998, ratios of from of 1.4**:**1 to 0.6**:**1 were obtained. In the current study the ratios fell to 0.8**:**1 to 0.4**:**1.

Thus, the most visible result from the current study is an apparent decrease in the amount of total PM_{10} contributed by elemental carbon, the inhalable particulate fraction targeted by Rule 1158. This result will be further tested by implementation of the next study in May 2000. Correlation of those spring results with the 1997 study will help provide a more complete picture of the ambient elemental carbon concentrations experienced by the communities of Wilmington and Long Beach throughout the year.

APPENDIX A-1

TOTAL CARBON ANALYSIS BY SAMPLE DATE

(CONCENTRATIONS in $\mu g/m^3$)

Date	Site	Total Mass	Total Carbon	Total % Carbon
11/2/99	HUD	92	17.8	19%
	ED	85	14	16%
	WIL	92	14.1	15%
11/8/99	HUD	38	10.1	27%
	ED	33	7.4	22%
	WIL	89	20.8	23%
11/14/99	HUD	50	10.8	22%
	ED	47	9.8	21%
	WIL	46	10.5	23%
11/20/99	HUD	30	7.2	24%
	ED	37	7.7	21%
	WIL	30	6.9	23%
11/26/99	HUD	47	17	36%
	ED	49	15.1	31%
	WIL	65	20	31%
12/2/99	HUD	69	21.2	31%
	ED	74	20.3	27%
	WIL	70	19	27%
12/8/99	HUD	68	17.1	25%
	ED	93	19.5	21%
	WIL			
12/14/99	HUD	171	40	23%
	ED	97	22.6	23%
	WIL	87	19.4	22%

APPENDIX A-2

ELEMENTAL CARBON ANALYSIS BY SAMPLE DATE

(CONCENTRATIONS in $\mu g/m^3$)

Date	Site	Total Mass	Elemental Carbon	% Elemental Carbon
11/2/99	HUD	92	7.9	8.6%
	ED	85	5.7	6.7%
	WIL	92	6	6.5%
11/8/99	HUD	38	4.1	10.8%
	ED	33	2.6	7.9%
	WIL	89	6.7	7.5%
11/14/99	HUD	50	4.8	9.6%
	ED	47	4	8.5%
	WIL	46	4.1	8.9%
11/20/99	HUD	30	2.7	9.0%
	ED	37	2.7	7.3%
	WIL	30	2.4	8.0%
11/26/99	HUD	47	5.9	12.6%
	ED	49	4.6	9.4%
	WIL	65	7.4	11.4%
12/2/99	HUD	69	7.9	11.4%
	ED	74	6.1	8.2%
	WIL	70	5.5	7.9%
12/8/99	HUD	68	6.6	9.7%
	ED	93	6.1	6.6%
	WIL	NS	NS	NS
12/14/99	HUD	171	17.8	10.4%
	ED	97	8.5	8.8%
	WIL	87	7.2	8.3%

APPENDIX A-3

ORGANIC TO ELEMENTAL CARBON ANALYSIS BY SAMPLE DATE

(CONCENTRATIONS in $\mu g/m^3$)

Date	Site	Elemental Carbon	Organic Carbon	Ratio EC/OC
11/2/99	HUD	7.9	9.9	0.8
	ED	5.7	8.3	0.7
	WIL	6	8.1	0.7
11/8/99	HUD	4.1	6	0.7
	ED	2.6	4.8	0.5
	WIL	6.7	14.1	0.5
11/14/99	HUD	4.8	6	0.8
	ED	4	5.8	0.7
	WIL	4.1	6.4	0.6
11/20/99	HUD	2.7	4.5	0.6
	ED	2.7	4.9	0.6
	WIL	2.4	4.4	0.5
11/26/99	HUD	5.9	11	0.5
	ED	4.6	10.5	0.4
	WIL	7.4	12.6	0.6
12/2/99	HUD	7.9	13.3	0.6
	ED	6.1	14.1	0.4
	WIL	5.5	13.5	0.4
12/8/99	HUD	6.6	10.4	0.6
	ED	6.1	13.4	0.5
	WIL			
12/14/99	HUD	17.8	22.2	0.8
	ED	8.5	14.2	0.6
	WIL	7.2	12.2	0.6