



**Trend Analysis of Ozone Concentrations in the City of Houston and Vicinity (2005-2009)**

City of Houston  
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**Introduction:** The City of Houston and surrounding area have been in non-attainment of the EPA ozone standard since a standard was set in 1977. Currently, the counties that make up the Houston-Galveston-Brazoria area (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery and Waller) are classified as ‘severe nonattainment’ and have until June 15, 2019 to attain the EPA ozone standard.

Although attainment of the ozone standard is an important regulatory measure of air quality, and is a necessary requirement to protect public health from ozone pollution, it only reflects a broad brush countywide count of the overall days with unhealthy pollution. Additional analyses conducted on a smaller scale (i.e., monitor by monitor area instead of countywide) provide a better understanding of the extent of the local health impact of Houston’s ozone levels and whether that impact is decreasing at a statistically significant rate over time as new controls and efforts are implemented. Such analyses include evaluation of an array of statistical measures of the daily maximum eight hour average of ozone (e.g., average, maximum, number of days above the level considered unhealthy for sensitive groups of the population) and the trend of these metrics over time. While ozone concentrations have dropped significantly over the past few decades, this trend analysis is focused on looking for changes on a shorter timeframe intended to reflect the impact from new controls (five years).

**Method and Results:** One hour ozone data collected from all available monitor locations in the Houston vicinity (2005-2009) were obtained from the Texas Commission on Environmental Quality. The data from each monitor were assessed to determine the percentage of data missing each year. Only monitors with five years of data with no more than 10% missing values were retained for analysis. Thirty-two monitors had data which met these criteria.

The data were aggregated by monitor to obtain the daily monitor maximum 8 hour average concentration. The daily monitor maximum 8 hour average concentrations were further aggregated by monitor into the following annual statistical metrics: average, standard deviation, median, maximum, number of days above the concentration of 75 parts per billion (ppb). The 75 ppb concentration is the concentration which is considered unhealthy for sensitive groups according to the EPA Air Quality Index ([http://www.tceq.state.tx.us/cgi-bin/compliance/monops/aqi\\_rpt.pl](http://www.tceq.state.tx.us/cgi-bin/compliance/monops/aqi_rpt.pl)).

The Mann Kendall test for trend was conducted at each monitor for each annual metric described above to identify statistically significant annual trends ( $\alpha=0.05$ ) for:

- Annual Average of the 8 hour maximum daily average (ppb)
- Annual Standard Deviation of the 8 hour maximum daily average (ppb)
- Annual Median of the 8 hour maximum daily average (ppb)
- Annual Maximum of the 8 hour maximum daily average (ppb)
- Total Number of days a monitor exhibited a daily maximum 8 hour average that was above the unhealthy level for sensitive groups, ozone concentration of 75 ppb.

The trend results and annual summary statistics are listed in Table 1.

Because a decreasing trend is more important at monitors with high concentrations than those with low concentrations, additional analysis was conducted to rank the monitors relative to each other according to magnitude of concentration. For example, each monitor was given a rank from 1 to 32 according to annual average concentration, with the rank of one assigned to the monitor with the highest concentration. This process was repeated for the annual maximum and the total number of days a monitor exhibited ozone concentrations above 75 ppb. The three ranks for each monitor were averaged to obtain an overall rank. The overall ranks were broken into three groups: high ozone severity (overall rank of 0 to 10.5), moderate ozone severity (>10.5 to 20.5), and low ozone severity (>20.5). The ranking results are listed in Table 2. Two statistics were not included in the rank, although trends were evaluated for these statistics: median and standard deviation. The median was not included because the average was included and therefore the rank based on central tendency was already represented. Including the rank of the median would constitute double counting the central tendency. The standard deviation, was not included because, it was felt that although the trend of the measure of spread may provide useful information about the behavior of the pollutant, (i.e., a decrease may mean fewer upper tail skewed values), it is not of the same weight as the other ranked metrics.

## Key Results

1. The individual monitor results indicate that 87.5% of the monitors have a statistically significant improving trend ( $\alpha=0.05$ ) in at least one ozone metric out of *all* ozone metrics evaluated over the past 5 years (Table 1). Figure 1 depicts the number of days at each monitor in 2009 that had concentrations above the level unhealthy for sensitive groups. The color green indicates that the monitor had an improving trend in *at least one of five ozone metrics* over the past five years. Figure 2 depicts the number of days at each monitor in 2009 that had concentrations above the level unhealthy for sensitive groups. The color green indicates that the monitor had an improving trend in this *individual* metric over the past five years while red indicates no improving trends were found.
2. In 2009, the monitors with the most severe ozone conditions (relative to the other monitors) were the monitors at Bayland Park, Northwest Harris County, Deer Park, Manvel Croix Park, Atascocita, Tom Bass, Meyer, and East (Table 2, Figure 3 and Figure 4). Of these 10 monitors with the most severe ozone, 30% show no improving trends, 20% show one improving trend and 50% show two or three improving trends (out of three trends evaluated: average, maximum and number of days above the level unhealthy for sensitive groups). Figure 3 depicts the ozone severity relative rank where a rank of 1 indicates low severity relative to the other monitors and 3 is highest severity. The color of the bars indicates the number of statistically significant improving trends found at the monitor. Figure 4 depicts the ozone severity relative rank by color where green indicates low severity relative to the other monitors and red is highest severity. The size of the dot marking the monitor location indicates the number of statistically significant improving trends found at the monitor. A largest size dot indicates all ozone metrics where improving at the location while the smallest dot indicates none were improving.

3. The individual monitor trend results over the past 5 years ( $\alpha=0.05$ ) for the ozone concentration average, maximum and number of days above the level unhealthy for sensitive groups indicate that (Figure 5)
  - a. 28% of the monitors have no statistically significant improving trends
  - b. 22% of the monitors have 1 statistically significant improving trend
  - c. 50% of the monitors have 2 or 3 statistically significant improving trends (28% and 22%, respectively)
4. When comparing the trends of ozone concentrations by monitor between the five years ending 2008 and the five years ending 2009, fourteen monitors (43% of the monitors) have additional ozone metrics showing improving trends.

**Figure 1**

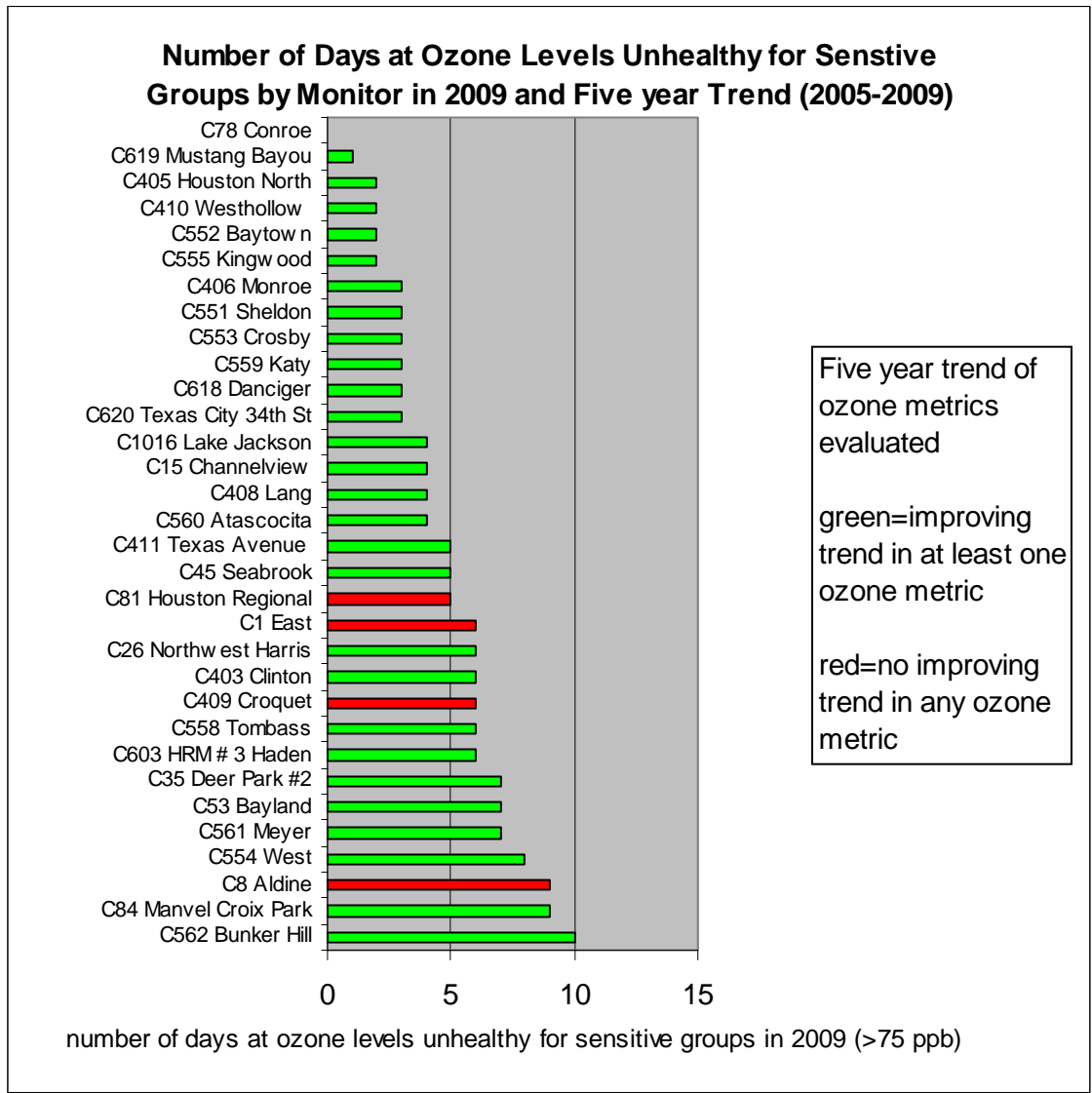


Figure 2

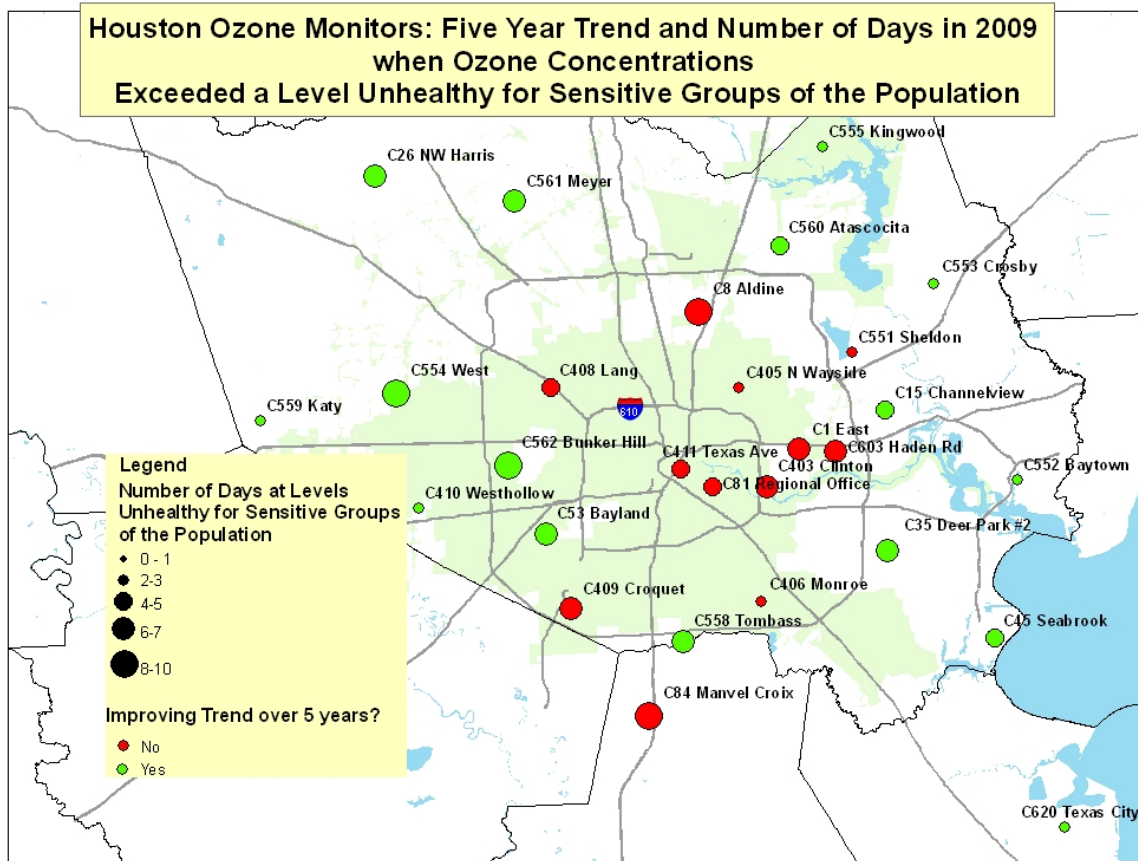
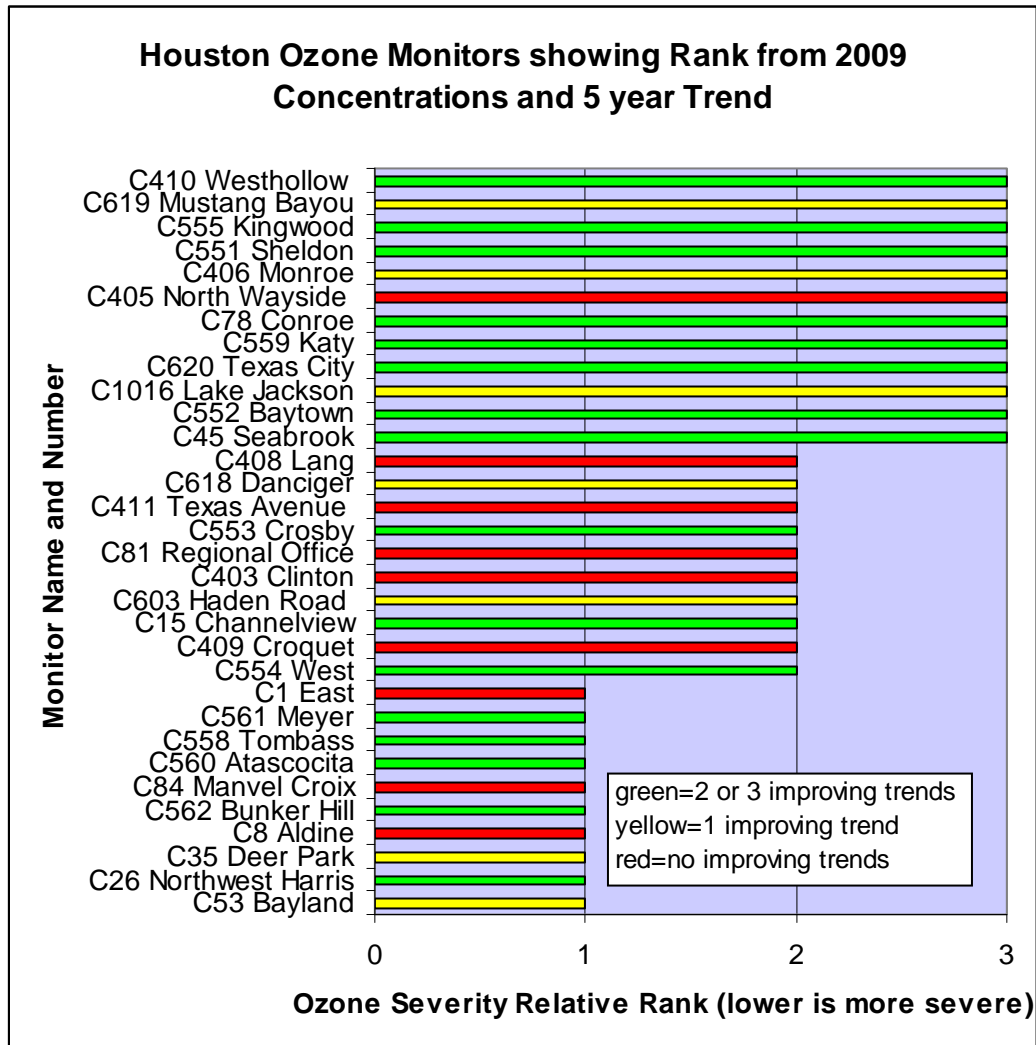
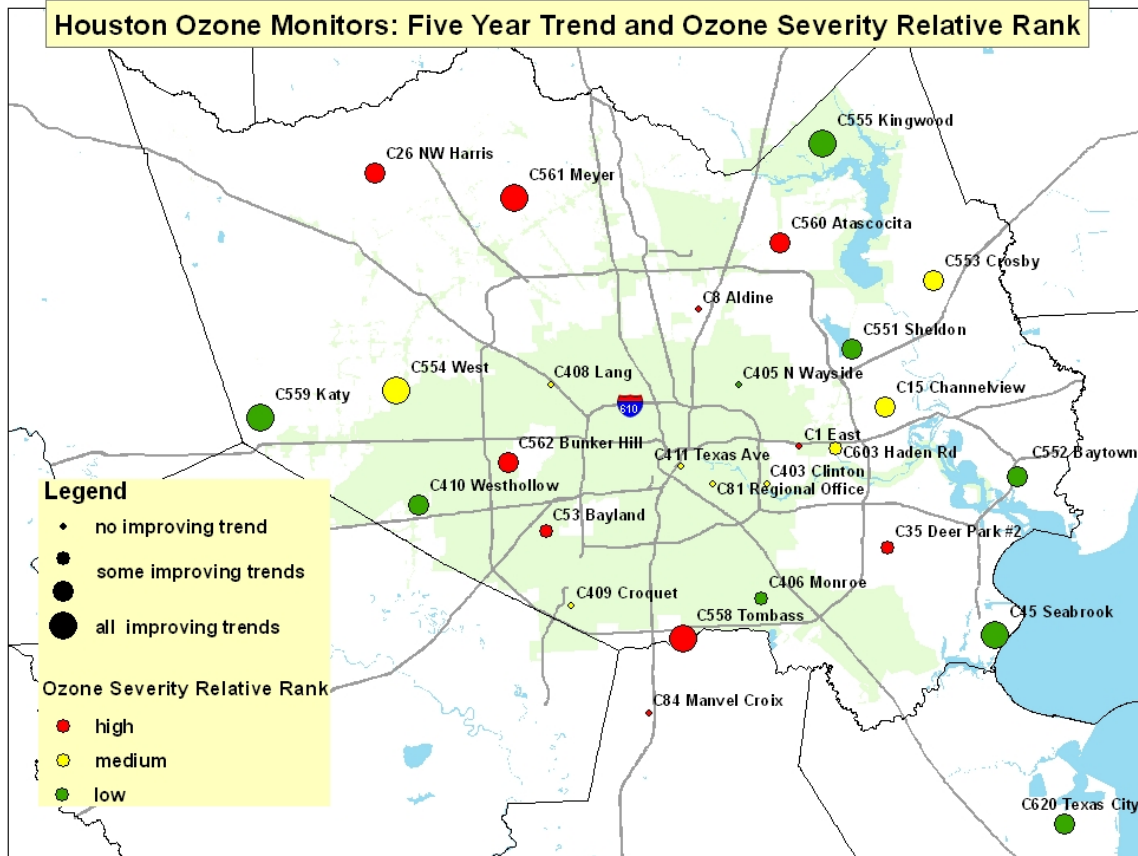


Figure 3



Note: ozone severity rank is based on average, maximum and number of days > 75 ppb

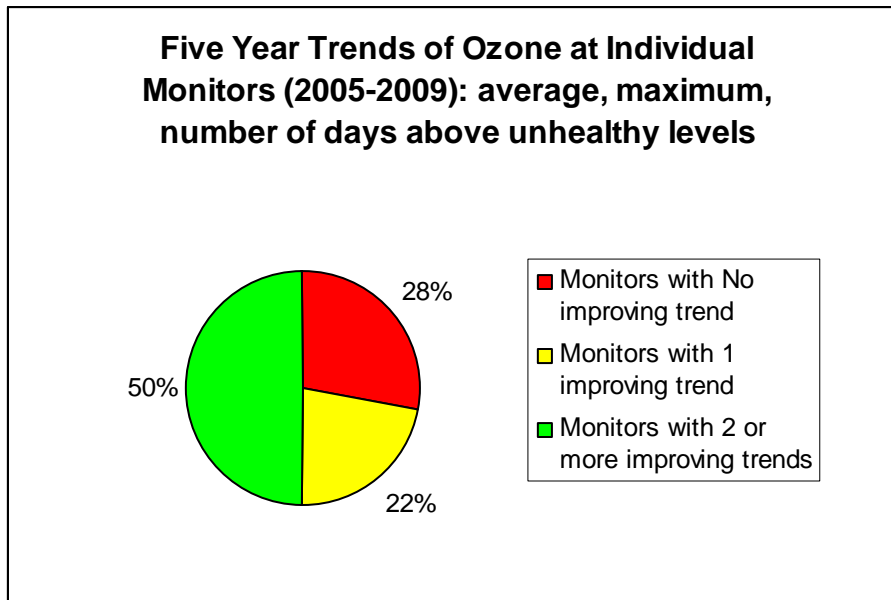
Figure 4



Note: Trend analysis depicted in this figure reflects trend of three key ozone metrics: average, maximum and number of days at levels unhealthy for sensitive groups.



**Figure 5**



Note: This figure is based on all 32 monitors

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank

<b>C1 East</b>	Annual statistics							Significant 5 yr downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	97%	99%	97%	97%	97%	93%	91%		
Average of 8hr max daily average	37.44	34.53	34.89	38.96	35.05	36.19	35.36	no	no
St. dev. of 8hr max daily average	20.91	18.06	15.07	19.05	15.56	14.99	15.94	no	no
Median of 8hr max daily average	33.38	30.38	33.38	35.00	34.06	33.38	33.25	no	no
Maximum of 8hr max daily average	112.13	125.63	77.00	111.25	77.75	83.25	110.38	no	no
Total Days > 75ppb	21	14	1	24	5	3	6	no	no
Relative Ozone Severity Rank	High		% of statistics showing downward trend					0%	0%
<b>C8 Aldine</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	99%	96%	92%	96%	98%	97%	no	no
Average of 8hr max daily average	42.38	40.32	43.65	40.93	41.69	43.92	39.16	no	no
St. dev. of 8hr max daily average	19.54	18.07	17.64	16.35	16.67	16.63	14.51	no	no
Median of 8hr max daily average	38.44	36.88	41.94	36.75	40.31	41.63	38.38	no	no
Maximum of 8hr max daily average	120.63	103.00	101.13	102.13	95.38	106.88	94.25	no	no
Total Days > 75ppb	26	14	14	10	18	14	9	no	no
Relative Ozone Severity Rank	High		% of statistics showing downward trend					0%	0%
<b>C15 Channelview</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	99%	99%	97%	98%	97%	97%	98%	no	yes
Average of 8hr max daily average	41.51	39.10	42.54	40.75	38.59	38.47	38.36	yes	yes
St. dev. of 8hr max daily average	18.16	17.15	16.78	16.14	15.37	13.81	14.24	no	yes
Median of 8hr max daily average	37.13	35.63	40.38	37.63	37.13	37.13	36.88	no	yes
Maximum of 8hr max daily average	112.13	104.88	92.63	104.63	92.75	81.13	92.38	yes	yes
Total Days > 75ppb	17	12	13	10	6	5	4	yes	yes
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					40%	80%
<b>C26 Northwest Harris County</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	95%	95%	98%	97%	98%	95%	no	yes
Average of 8hr max daily average	43.45	42.07	46.22	44.87	42.16	42.12	42.10	yes	yes
St. dev. of 8hr max daily average	18.01	17.35	17.31	16.42	16.23	14.19	14.61	no	no
Median of 8hr max daily average	39.50	38.75	44.38	41.25	39.13	40.13	40.88	yes	no
Maximum of 8hr max daily average	121.00	113.25	116.75	103.14	100.63	82.75	103.25	no	yes
Total Days > 75ppb	23	13	23	20	14	7	6	40%	60%
Relative Ozone Severity Rank	High		% of statistics showing downward trend					40%	60%
<b>C35 Deer Park #2</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	95%	95%	97%	96%	97%	94%	96%	no	no
Average of 8hr max daily average	44.71	39.95	43.48	41.52	38.73	39.35	38.98	yes	yes
St. dev. of 8hr max daily average	20.61	18.85	18.81	17.83	16.30	15.68	15.46	no	no
Median of 8hr max daily average	39.63	35.00	39.81	37.50	36.38	36.19	37.53	no	no
Maximum of 8hr max daily average	126.88	118.63	104.50	121.38	98.75	91.88	102.25	yes	yes
Total Days > 75ppb	30	18	28	17	9	5	7	40%	40%
Relative Ozone Severity Rank	High		% of statistics showing downward trend					40%	40%

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C45 Seabrook</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	99%	97%	99%	99%	96%	94%		
Average of 8hr max daily average	39.81	40.45	45.17	42.95	40.99	39.66	35.26	no	yes
St. dev. of 8hr max daily average	17.72	18.03	18.18	16.35	16.15	14.37	13.96	yes	yes
Median of 8hr max daily average	35.14	36.25	42.75	40.13	39.13	37.25	34.38	no	yes
Maximum of 8hr max daily average	130.00	105.88	118.00	119.63	94.88	89.25	83.63	no	yes
Total Days > 75ppb	14	18	21	15	14	3	5	yes	yes
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					40%	100%
<b>C53 Bayland</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	97%	99%	97%	96%	98%	93%	97%		
Average of 8hr max daily average	42.75	40.79	43.93	41.87	37.60	37.97	39.35	no	no
St. dev. of 8hr max daily average	21.11	21.01	19.91	18.75	16.59	15.16	15.50	yes	yes
Median of 8hr max daily average	38.25	35.00	41.44	37.75	35.13	34.94	37.88	no	no
Maximum of 8hr max daily average	129.75	114.13	106.13	124.25	92.13	92.00	106.63	no	no
Total Days > 75ppb	29	25	30	17	11	6	7	yes	yes
Relative Ozone Severity Rank	High		% of statistics showing downward trend					40%	40%
<b>C78 Conroe</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	97%	99%	96%	98%	98%	98%	98%		
Average of 8hr max daily average	42.86	41.98	46.49	45.55	40.15	41.86	38.71	no	yes
St. dev. of 8hr max daily average	15.66	13.96	15.65	15.55	13.65	13.16	11.75	no	yes
Median of 8hr max daily average	40.50	40.25	46.25	42.63	39.25	41.25	39.25	no	no
Maximum of 8hr max daily average	117.75	104.13	123.50	110.00	78.50	85.75	67.25	no	yes
Total Days > 75ppb	11	5	18	13	6	3	0	no	yes
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					0%	80%
<b>C81 Houston Regional Office</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	97%	98%	98%	99%	98%	96%	98%		
Average of 8hr max daily average	34.03	31.66	40.47	37.37	29.83	33.14	32.72	no	no
St. dev. of 8hr max daily average	19.40	17.07	18.57	17.65	14.41	14.77	14.91	no	no
Median of 8hr max daily average	29.00	27.63	37.88	33.50	27.88	30.75	31.13	no	no
Maximum of 8hr max daily average	115.50	125.38	101.75	101.88	72.00	79.63	103.13	no	no
Total Days > 75ppb	11	5	16	14	0	2	5	no	no
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					0%	0%
<b>C84 Manvel Croix Park</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	97%	96%	97%	93%	96%	95%		
Average of 8hr max daily average	40.19	42.09	42.94	42.94	38.39	38.97	38.28	no	no
St. dev. of 8hr max daily average	19.64	20.78	18.70	18.50	16.82	15.06	15.49	yes	yes
Median of 8hr max daily average	36.50	36.44	39.81	38.75	36.27	37.00	36.63	no	no
Maximum of 8hr max daily average	111.63	116.00	100.00	121.17	100.88	86.75	96.63	no	no
Total Days > 75ppb	23	32	24	29	10	6	9	yes	no
Relative Ozone Severity Rank	High		% of statistics showing downward trend					40%	20%

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C403 Clinton</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	96%	97%	94%	96%	92%	92%	96%	no	no
Average of 8hr max daily average	36.91	34.35	35.36	28.76	30.37	33.50	33.36	yes	yes
St. dev. of 8hr max daily average	21.10	18.88	17.72	15.90	16.69	15.26	14.62	no	no
Median of 8hr max daily average	30.63	28.56	31.14	25.38	27.60	31.00	31.13	yes	no
Maximum of 8hr max daily average	126.14	118.88	98.38	90.00	79.63	89.71	101.25	yes	no
Total Days > 75ppb	23	16	10	5	3	2	6	yes	no
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					60%	20%
<b>C405 Houston North Wayside</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	97%	98%	93%	97%	97%	96%	96%	no	no
Average of 8hr max daily average	37.07	34.45	36.42	37.35	35.05	35.06	32.75	no	no
St. dev. of 8hr max daily average	19.37	17.02	15.73	15.91	15.99	14.27	13.87	no	no
Median of 8hr max daily average	32.57	30.33	33.75	33.50	33.25	33.13	31.63	no	yes
Maximum of 8hr max daily average	119.38	122.50	80.25	95.38	85.50	80.00	92.88	no	no
Total Days > 75ppb	18	10	1	7	5	2	2	no	no
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					0%	20%
<b>C406 Monroe</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	96%	98%	96%	97%	98%	95%	96%	no	no
Average of 8hr max daily average	37.62	36.39	42.73	39.83	31.56	34.55	32.08	yes	yes
St. dev. of 8hr max daily average	18.37	18.62	19.27	17.37	14.19	13.76	13.77	no	no
Median of 8hr max daily average	34.00	31.13	38.66	36.17	28.88	32.56	30.50	yes	yes
Maximum of 8hr max daily average	102.50	107.00	107.00	106.00	93.00	74.88	88.86	yes	no
Total Days > 75ppb	15	17	26	12	3	0	3	yes	no
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					60%	40%
<b>C408 Lang</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	98%	96%	96%	97%	95%	97%	no	no
Average of 8hr max daily average	31.25	30.41	32.08	31.35	32.26	35.61	34.76	yes	yes
St. dev. of 8hr max daily average	17.30	17.82	16.15	16.15	15.47	14.77	14.77	no	no
Median of 8hr max daily average	27.57	25.63	28.75	27.13	29.63	33.28	32.88	yes	no
Maximum of 8hr max daily average	88	125.4	90	95.33	82.13	75.88	91.57	no	no
Total Days > 75ppb	8	9	3	6	1	1	4	yes	no
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					40%	20%
<b>C409 Croquet</b>	Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	98%	98%	96%	98%	97%	93%	98%	no	no
Average of 8hr max daily average	40.50	39.56	41.31	36.77	33.64	38.09	36.18	yes	no
St. dev. of 8hr max daily average	19.96	20.36	19.31	16.43	14.17	14.92	15.01	no	no
Median of 8hr max daily average	35.50	34.13	37.94	33.13	31.71	35.38	34.83	no	no
Maximum of 8hr max daily average	129.25	114.00	109.50	109.67	82.57	93.13	100.00	yes	no
Total Days > 75ppb	24	25	22	11	3	5	6	yes	no
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					40%	0%

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C410 Westhollow</b>		Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009	
Percent of year with data coverage	97%	92%	95%	98%	96%	91%	96%			
Average of 8hr max daily average	33.54	37.30	41.81	40.71	37.40	34.92	34.42	no	yes	
St. dev. of 8hr max daily average	16.68	19.80	18.07	18.22	16.85	14.54	13.62	yes	yes	
Median of 8hr max daily average	30.00	32.63	38.68	36.50	34.31	32.39	33.63	no	yes	
Maximum of 8hr max daily average	97.83	108.3	103.8	126.6	105.1	84.25	80.13	no	no	
Total Days > 75ppb	9	21	22	18	10	4	2	yes	yes	
Relative Ozone Severity Rank	Low	% of statistics showing downward trend						40%	80%	
<b>C411 Texas Avenue</b>		Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009	
Percent of year with data coverage	96%	97%	90%	90%	97%	94%	95%			
Average of 8hr max daily average	35.37	34.11	35.66	32.03	33.77	34.54	32.26	no	no	
St. dev. of 8hr max daily average	20.46	19.68	17.81	17.69	16.09	15.16	14.63	yes	yes	
Median of 8hr max daily average	30.00	27.63	32.50	26.93	31.50	32.00	30.63	no	no	
Maximum of 8hr max daily average	112.88	118.50	90.75	95.75	82.00	82.88	95.00	no	no	
Total Days > 75ppb	18	16	5	11	6	1	5	no	no	
Relative Ozone Severity Rank	Moderate	% of statistics showing downward trend						20%	20%	
<b>C551 Sheldon</b>		Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009	
Percent of year with data coverage	98%	100%	99%	98%	97%	93%	92%			
Average of 8hr max daily average	42.42	39.54	44.50	41.56	37.12	37.12	35.19	no	yes	
St. dev. of 8hr max daily average	17.76	16.21	16.42	15.90	14.56	14.81	13.40	no	yes	
Median of 8hr max daily average	38.63	36.69	43.25	38.63	36.63	36.13	34.25	no	yes	
Maximum of 8hr max daily average	120.63	105.38	103.88	100.00	84.88	95.63	80.38	yes	yes	
Total Days > 75ppb	17	12	9	11	1	4	3	no	no	
Relative Ozone Severity Rank	Low	% of statistics showing downward trend						20%	80%	
<b>C552 Baytown</b>		Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009	
Percent of year with data coverage	52%	99%	99%	100%	100%	85%	100%			
Average of 8hr max daily average	40.90	40.52	43.69	42.82	39.87	39.99	37.34	no	yes	
St. dev. of 8hr max daily average	16.98	17.30	16.88	16.72	15.66	14.88	13.86	yes	yes	
Median of 8hr max daily average	36.75	36.31	40.25	38.63	38.13	37.25	36.50	no	yes	
Maximum of 8hr max daily average	111.00	107.88	97.88	122.38	91.00	101.75	86.00	no	no	
Total Days > 75ppb	7	13	13	15	8	3	2	no	yes	
Relative Ozone Severity Rank	Low	% of statistics showing downward trend						20%	80%	
<b>C553 Crosby</b>		Annual statistics							Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009	
Percent of year with data coverage	53%	99%	99%	100%	100%	97%	100%			
Average of 8hr max daily average	43.04	41.46	46.78	43.54	40.55	41.47	38.43	no	yes	
St. dev. of 8hr max daily average	15.46	15.11	16.62	14.98	14.90	14.50	12.94	yes	yes	
Median of 8hr max daily average	41.13	39.13	45.50	40.75	39.25	39.94	38.13	no	yes	
Maximum of 8hr max daily average	99.50	105.00	125.25	99.88	112.50	104.75	86.25	no	no	
Total Days > 75ppb	5	13	16	11	8	4	3	yes	yes	
Relative Ozone Severity Rank	Moderate	% of statistics showing downward trend						40%	80%	

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C554 West</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	99%	99%	100%	99%	99%	99%	2004-2008	2005-2009
Average of 8hr max daily average	NA	38.68	45.51	43.58	40.05	40.54	38.54	no	yes
St. dev. of 8hr max daily average	NA	19.38	19.09	18.38	16.88	15.52	14.78	yes	yes
Median of 8hr max daily average	NA	34.25	42.75	39.75	36.88	37.81	37.00	no	no
Maximum of 8hr max daily average	NA	123.50	104.25	118.50	92.75	87.13	86.25	yes	yes
Total Days > 75ppb	NA	18	27	24	13	9	8	no	yes
Relative Ozone Severity Rank	Moderate		% of statistics showing downward trend					40%	80%
<b>C555 Kingwood</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	63%	98%	100%	99%	98%	99%	2004-2008	2005-2009
Average of 8hr max daily average	NA	41.01	44.94	41.85	38.12	37.91	37.34	NA	yes
St. dev. of 8hr max daily average	NA	14.90	16.55	15.24	14.05	14.33	13.36	NA	yes
Median of 8hr max daily average	NA	39.44	44.38	38.13	36.88	36.50	37.19	NA	no
Maximum of 8hr max daily average	NA	87.75	122.13	101.75	86.63	87.63	76.88	NA	yes
Total Days > 75ppb	NA	7	15	13	3	4	2	NA	yes
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					NA	80%
<b>C558 Tombass</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	89%	97%	100%	100%	98%	99%	2004-2008	2005-2009
Average of 8hr max daily average	NA	43.31	44.85	42.88	39.53	40.28	37.36	NA	yes
St. dev. of 8hr max daily average	NA	21.05	20.19	18.64	17.75	16.20	15.69	NA	yes
Median of 8hr max daily average	NA	37.63	41.13	39.00	36.86	38.38	35.38	NA	yes
Maximum of 8hr max daily average	NA	121.50	121.50	119.75	118.00	85.38	102.25	NA	yes
Total Days > 75ppb	NA	33	31	23	15	7	6	NA	yes
Relative Ozone Severity Rank	High		% of statistics showing downward trend					NA	100%
<b>C559 Katy</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	80%	99%	100%	99%	98%	100%	2004-2008	2005-2009
Average of 8hr max daily average	NA	40.93	45.49	43.09	39.85	39.93	36.33	NA	yes
St. dev. of 8hr max daily average	NA	17.70	18.09	17.51	16.22	15.03	13.65	NA	yes
Median of 8hr max daily average	NA	36.50	42.50	39.50	37.31	37.75	34.38	NA	yes
Maximum of 8hr max daily average	NA	118.25	103.88	120.00	96.88	89.00	78.13	NA	yes
Total Days > 75ppb	NA	15	26	19	11	7	3	NA	yes
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					NA	100%
<b>C560 Atascocita</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	41%	98%	100%	99%	97%	98%	2004-2008	2005-2009
Average of 8hr max daily average	NA	41.31	47.06	44.21	40.35	41.59	38.68	NA	yes
St. dev. of 8hr max daily average	NA	16.85	16.92	15.99	14.63	14.93	14.71	NA	no
Median of 8hr max daily average	NA	37.88	46.81	41.00	38.81	40.00	38.50	NA	yes
Maximum of 8hr max daily average	NA	94.25	117.00	102.88	84.38	98.00	107.00	NA	no
Total Days > 75ppb	NA	9	17	20	7	5	4	NA	yes
Relative Ozone Severity Rank	High		% of statistics showing downward trend					NA	60%

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C561 Meyer</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	40%	99%	100%	100%	98%	99%	2004-2008	2005-2009
Average of 8hr max daily average	NA	40.42	47.08	44.32	40.83	41.66	38.86	NA	yes
St. dev. of 8hr max daily average	NA	19.07	18.38	17.25	16.25	14.74	14.33	NA	yes
Median of 8hr max daily average	NA	35.88	44.88	40.38	37.50	40.00	38.38	NA	no
Maximum of 8hr max daily average	NA	110.13	107.63	103.63	96.88	83.00	87.50	NA	yes
Total Days > 75ppb	NA	7	28	21	15	5	7	NA	yes
Relative Ozone Severity Rank	High	% of statistics showing downward trend						NA	80%
<b>C562 Bunker Hill</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	0%	22%	100%	97%	99%	100%	98%	2004-2008	2005-2009
Average of 8hr max daily average	NA	27.10	44.82	43.41	38.92	40.30	37.81	NA	yes
St. dev. of 8hr max daily average	NA	9.61	19.89	19.53	17.15	16.62	15.99	NA	yes
Median of 8hr max daily average	NA	28.75	41.75	39.38	36.00	37.00	36.50	NA	no
Maximum of 8hr max daily average	NA	53.63	103.50	121.75	90.13	93.50	99.00	NA	no
Total Days > 75ppb	NA	0	31	27	14	11	10	NA	yes
Relative Ozone Severity Rank	High	% of statistics showing downward trend						NA	60%
<b>C603 HRM # 3 Haden Road</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	55%	94%	94%	98%	95%	95%	97%	2004-2008	2005-2009
Average of 8hr max daily average	39.13	35.32	40.62	39.38	36.22	35.97	34.97	no	yes
St. dev. of 8hr max daily average	19.46	17.39	18.15	18.54	15.77	15.04	15.07	no	no
Median of 8hr max daily average	33.88	30.50	37.56	35.25	34.63	33.13	32.71	no	yes
Maximum of 8hr max daily average	110.13	113.50	92.63	117.63	81.00	89.50	99.38	no	no
Total Days > 75ppb	9	14	11	20	4	2	6	no	no
Relative Ozone Severity Rank	Moderate	% of statistics showing downward trend						0%	40%
<b>C618 Danciger</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	49%	98%	91%	98%	98%	96%	96%	2004-2008	2005-2009
Average of 8hr max daily average	38.79	40.76	42.32	41.58	37.51	36.75	36.80	no	yes
St. dev. of 8hr max daily average	16.13	17.70	17.25	16.13	15.81	15.06	14.46	yes	yes
Median of 8hr max daily average	37.31	38.13	40.56	40.00	36.38	35.38	35.25	no	yes
Maximum of 8hr max daily average	86.75	104.13	96.38	87.13	90.88	93.13	86.63	no	no
Total Days > 75ppb	5	21	13	14	6	6	3	no	no
Relative Ozone Severity Rank	Moderate	% of statistics showing downward trend						20%	60%
<b>C619 Mustang Bayou</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	50%	98%	97%	98%	96%	93%	95%	2004-2008	2005-2009
Average of 8hr max daily average	44.17	43.16	44.47	41.06	42.00	41.10	34.74	no	no
St. dev. of 8hr max daily average	18.74	18.63	17.55	16.55	16.50	15.79	13.38	yes	yes
Median of 8hr max daily average	40.83	39.13	41.75	38.38	39.50	39.31	35.38	no	no
Maximum of 8hr max daily average	109.88	103.75	84.63	91.88	97.88	79.38	81.38	no	no
Total Days > 75ppb	15	21	17	13	14	6	1	yes	yes
Relative Ozone Severity Rank	Low	% of statistics showing downward trend						40%	40%

Table 1 Houston Area Ozone Monitor Annual Statistics (ppb), Trend and Relative Ozone Severity Rank (Cont.)

<b>C620 Texas City 34th St</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	45%	97%	94%	95%	96%	96%	98%	yes	yes
Average of 8hr max daily average	41.92	43.18	42.70	40.60	38.11	38.59	35.35	yes	yes
St. dev. of 8hr max daily average	18.57	19.99	18.09	16.57	16.24	15.13	14.47	yes	yes
Median of 8hr max daily average	38.13	38.25	40.50	38.38	36.00	37.25	34.75	no	yes
Maximum of 8hr max daily average	117.88	114.50	92.50	92.50	94.25	94.25	84.38	no	no
Total Days > 75ppb	11	24	15	11	7	3	3	yes	yes
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					60%	80%
<b>C1016 Lake Jackson</b>		Annual statistics						Significant downward trend?	
Year	2003	2004	2005	2006	2007	2008	2009	2004-2008	2005-2009
Percent of year with data coverage	52%	91%	94%	96%	99%	97%	99%	no	yes
Average of 8hr max daily average	37.90	37.55	40.49	39.02	36.25	38.23	35.84	yes	yes
St. dev. of 8hr max daily average	17.69	16.98	17.36	15.60	15.16	14.83	14.38	no	no
Median of 8hr max daily average	35.63	33.38	38.13	36.81	34.88	37.56	36.13	no	no
Maximum of 8hr max daily average	102.13	88.50	84.63	84.00	81.00	86.50	77.38	no	no
Total Days > 75ppb	7	10	7	10	3	4	4	no	no
Relative Ozone Severity Rank	Low		% of statistics showing downward trend					20%	40%



Table 2 Houston Area Ozone (ppb) Monitor Severity Ranking

Monitor	Total Days > 75 ppb	Rank	Maximum of 8hr max daily average	Rank	Average of 8hr max daily	Rank	Average Rank	Ozone Severity Rank
C53 Bayland	7	6	106.63	3	39.35	2	3.7	1
C26 Northwest Harris County	6	10.5	103.25	4	42.10	1	5.2	1
C35 Deer Park #2	7	6	102.25	6.5	38.98	4	5.5	1
C8 Aldine	9	2.5	94.25	14	39.16	3	6.5	1
C562 Bunker Hill	10	1	99.00	11	37.81	12	8.0	1
C84 Manvel Croix Park	9	2.5	96.63	12	38.28	11	8.5	1
C560 Atascocita	4	18.5	107.00	2	38.68	7	9.2	1
C558 Tombass	6	10.5	102.25	6.5	37.36	13	10.0	1
C561 Meyer	7	6	87.50	19	38.86	5	10.0	1
C1 East	6	10.5	110.38	1	35.36	20	10.5	1
C554 West	8	4	86.25	21.5	38.54	8	11.2	2
C409 Croquet	6	10.5	100.00	9	36.18	18	12.5	2
C15 Channelview	4	18.5	92.38	16	38.36	10	14.8	2
C603 HRM # 3 Haden Road	6	10.5	99.38	10	34.97	24	14.8	2
C403 Clinton	6	10.5	101.25	8	33.36	28	15.5	2
C81 Houston Regional Office	5	15	103.13	5	32.72	30	16.7	2
C553 Crosby	3	23.5	86.25	21.5	38.43	9	18.0	2
C411 Texas Avenue	5	15	95.00	13	32.26	31	19.7	2
C618 Danciger	3	23.5	86.63	20	36.80	16	19.8	2
C408 Lang	4	18.5	91.57	17	34.76	25	20.2	2
C45 Seabrook	5	15	83.63	25	35.26	22	20.7	3
C552 Baytown	2	28.5	86.00	23	37.34	15	22.2	3
C1016 Lake Jackson	4	18.5	77.38	30	35.84	19	22.5	3
C620 Texas City 34th St	3	23.5	84.38	24	35.35	21	22.8	3
C559 Katy	3	23.5	78.13	29	36.33	17	23.2	3
C78 Conroe	0	32	67.25	32	38.71	6	23.3	3
C405 Houston North Wayside	2	28.5	92.88	15	32.75	29	24.2	3
C406 Monroe	3	23.5	88.86	18	32.08	32	24.5	3
C551 Sheldon	3	23.5	80.38	27	35.19	23	24.5	3
C555 Kingwood	2	28.5	76.88	31	37.34	14	24.5	3
C619 Mustang Bayou	1	31	81.38	26	34.74	26	27.7	3
C410 Westhollow	2	28.5	80.13	28	34.42	27	27.8	3