



Air Quality Assessment Program
Air Monitoring
Report 1991



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Air Quality Assessment Program
Air Monitoring
Report 1991

by

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and Monitoring Operations Staff

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INTRODUCTION

This report provides a summary of air quality measurements collected in the State of Texas by the Texas Natural Resource Conservation Commission (TNRCC), other government, and private monitoring networks. The summaries presented in this report are based on routine measurements from all of the monitoring sites operated by the TNRCC and by the local government and private organizations listed in the adjacent box.

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six atmospheric criteria pollutants — ozone (O₃), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), particulate matter of ten microns or less (PM₁₀), and lead. The gaseous criteria pollutants, O₃, CO, SO₂, and NO₂, are monitored on a continuous basis with one-hour averages recorded for every hour of the day on every day. PM₁₀ and lead are sampled on a non-continuous basis with one 24-hour average recorded once every sixth day at most sites, although a few sites monitor every other day or every day.

Other governmental agencies that perform air quality monitoring in and near Texas cities:

- City of Dallas
- City of Fort Worth
- City of Houston
- El Paso City-County Health District
- Galveston County Health District
- New Mexico Air Quality Bureau

Private organizations that perform air quality monitoring:

- Houston Regional Monitoring (HRM) Corporation
- Southeast Texas Regional Planning Commission (SETRPC)

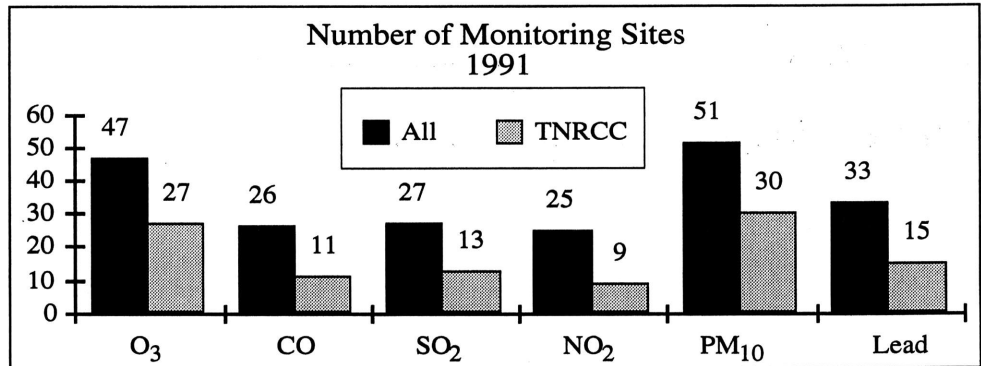


Table 1. National Ambient Air Quality Standards

Pollutant	Averaging Period	Primary NAAQS	Secondary NAAQS
O ₃ *	1-hr	0.12 ppm	0.12 ppm
CO **	1-hr	35 ppm	35 ppm
	8-hr	9 ppm	9 ppm
SO ₂ **	3-hr	—	0.5 ppm
	24-hr	0.14 ppm	—
	Annual	0.03 ppm	—
NO ₂ ***	Annual	0.053 ppm	0.053 ppm
PM ₁₀ *	24-hr	150 µg/m ³	150 µg/m ³
	Annual	50 µg/m ³	50 µg/m ³
Lead ***	Qtr	1.5 µg/m ³	1.5 µg/m ³

* Not to be exceeded on more than three days over three years.

** Not to be exceeded more than once per calendar year.

*** Not to be exceeded.

Primary NAAQS — The levels of air quality which the EPA Administrator judges necessary, with an adequate margin of safety, to protect the public health.

Secondary NAAQS — The levels of air quality which the EPA Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects.

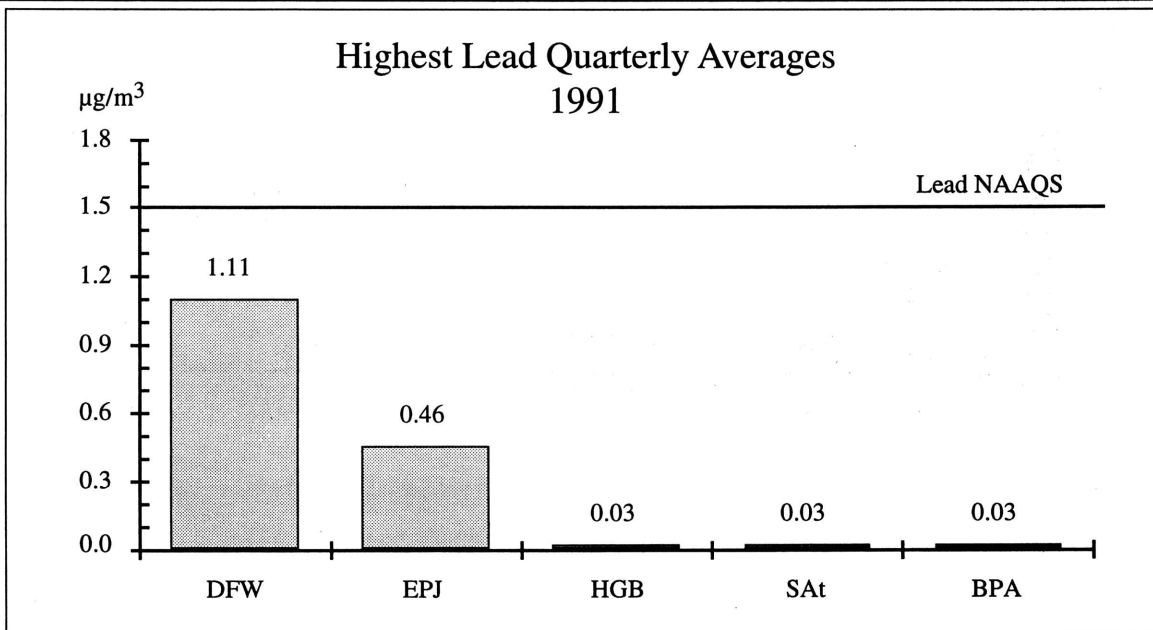
CRITERIA POLLUTANT SUMMARY

During 1991, the state, local, and private monitoring networks measured levels of O₃, CO, SO₂, and PM₁₀ above the concentration levels defined by the NAAQS. Measured levels of NO₂ and lead were below the NAAQS.

O₃	Measurements above 0.12 parts per million (ppm) were recorded in the Beaumont–Port Arthur, Dallas–Fort Worth, El Paso, and Houston–Galveston–Brazoria metropolitan areas. Measurements of O ₃ did not exceed 0.12 ppm during 1991 at any of the monitoring sites in the Austin, Corpus Christi, Longview, San Antonio, and Victoria areas. The highest O ₃ one-hour average measurement during 1991 was 0.24 ppm in the Houston area.	CO	Eight-hour concentrations above 9 ppm were recorded only in the El Paso–Juarez area, where a high measurement of 11.3 ppm was observed. Three of the six U. S. El Paso area sites recorded violations of the eight-hour CO NAAQS.
PM₁₀	One of the eight Texas sites in El Paso recorded a daily measurement above 150 micrograms per cubic meter (µg/m ³). The high daily average was 159 µg/m ³ . In nearby Juarez (Mexico), the highest 24-hour measurement was 318 µg/m ³ and at adjacent New Mexico sites the peak was 162 µg/m ³ .	SO₂	One site in the Houston area recorded a peak 24-hour average of 0.174 ppm, which exceeds the SO ₂ 24-hour NAAQS. However, the second high 24-hour average at this site did not exceed the NAAQS, so the site did not violate the NAAQS.

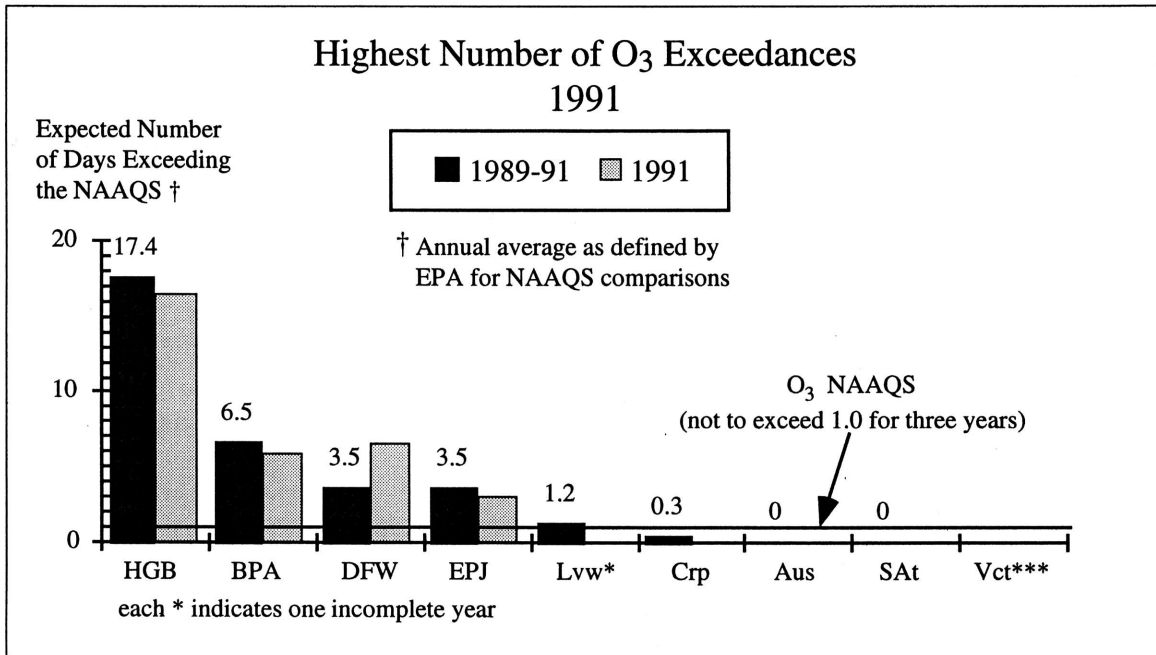
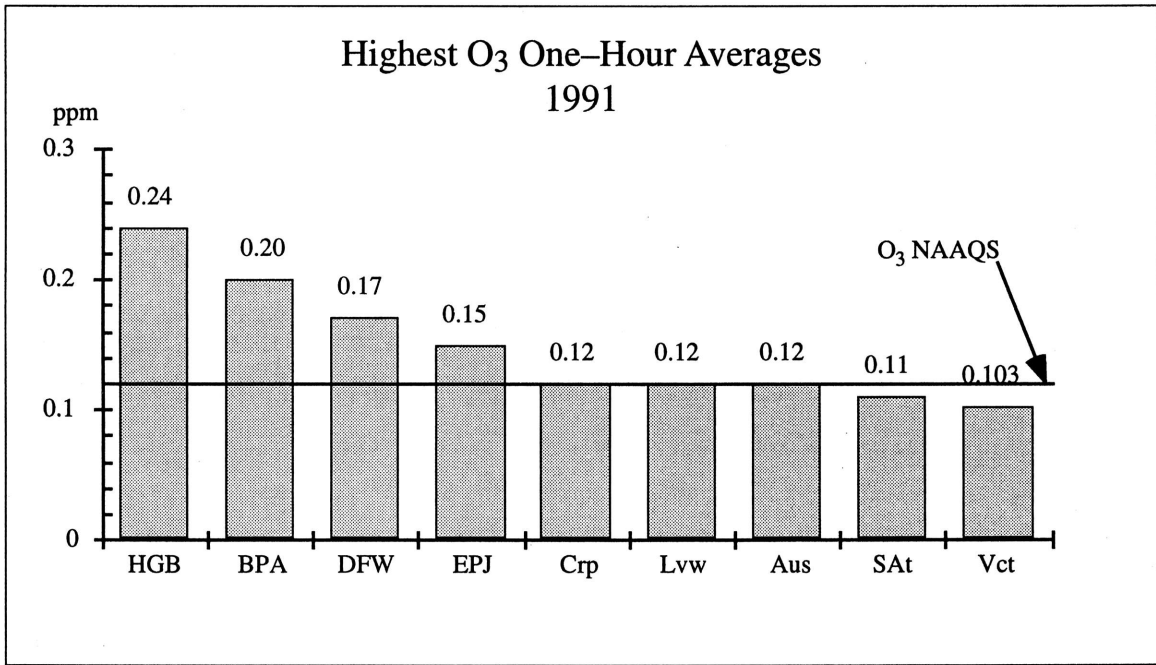
The following graphs display comparisons of peak criteria pollutant measurements for metropolitan areas and regional areas where the pollutants are monitored. Each graph shows the highest measurement recorded at any one site in each of the areas shown. The graphs for CO and SO₂ also include the second high which is used for CO and SO₂ NAAQS determinations. Abbreviations are listed on page 27. Table 2 provides a summary listing by site with a comparison to the NAAQS for all of the criteria pollutants beginning on page 9. Additional summary information is provided by pollutant in the following sections of the report.

Comparisons by Metropolitan Area

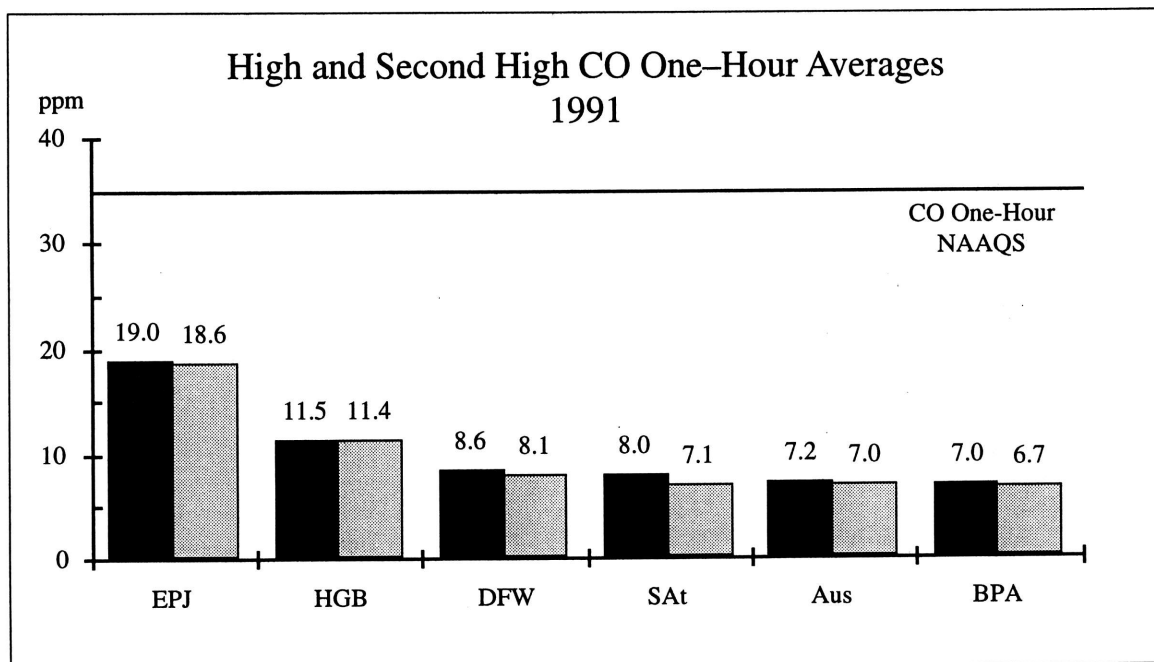
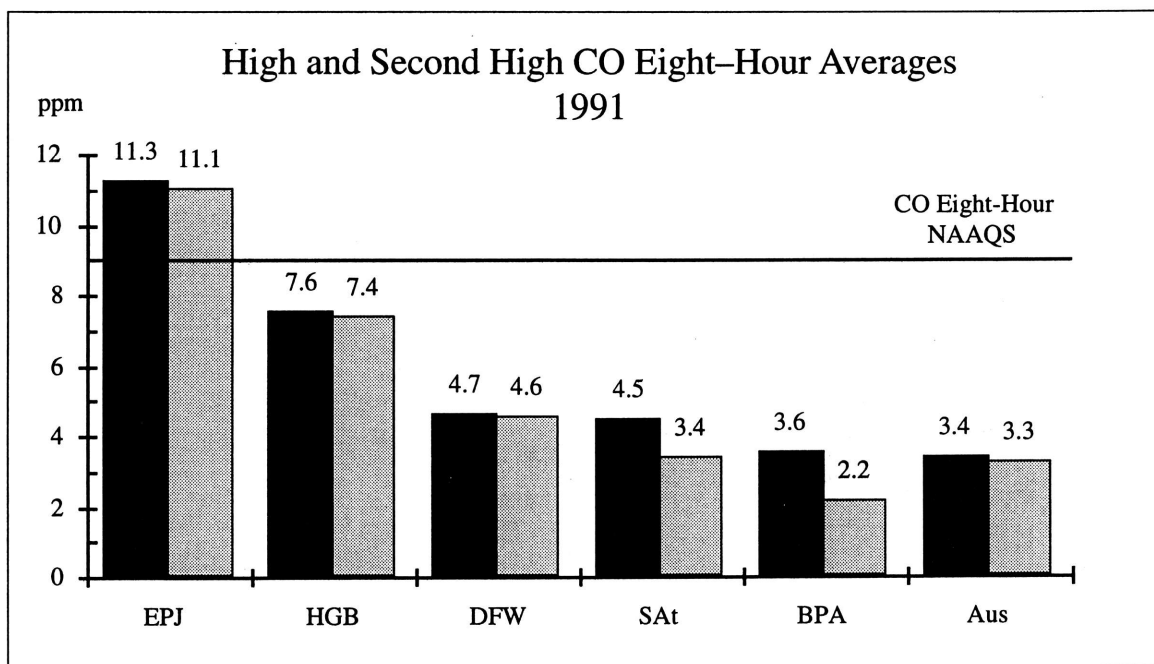


Note: The highest lead measurements in the Dallas–Fort Worth and El Paso areas were from sites near lead smelters. Sites that were not located near lead smelters in these two areas reported very low measurements similar to those from the Houston–Galveston–Brazoria area.

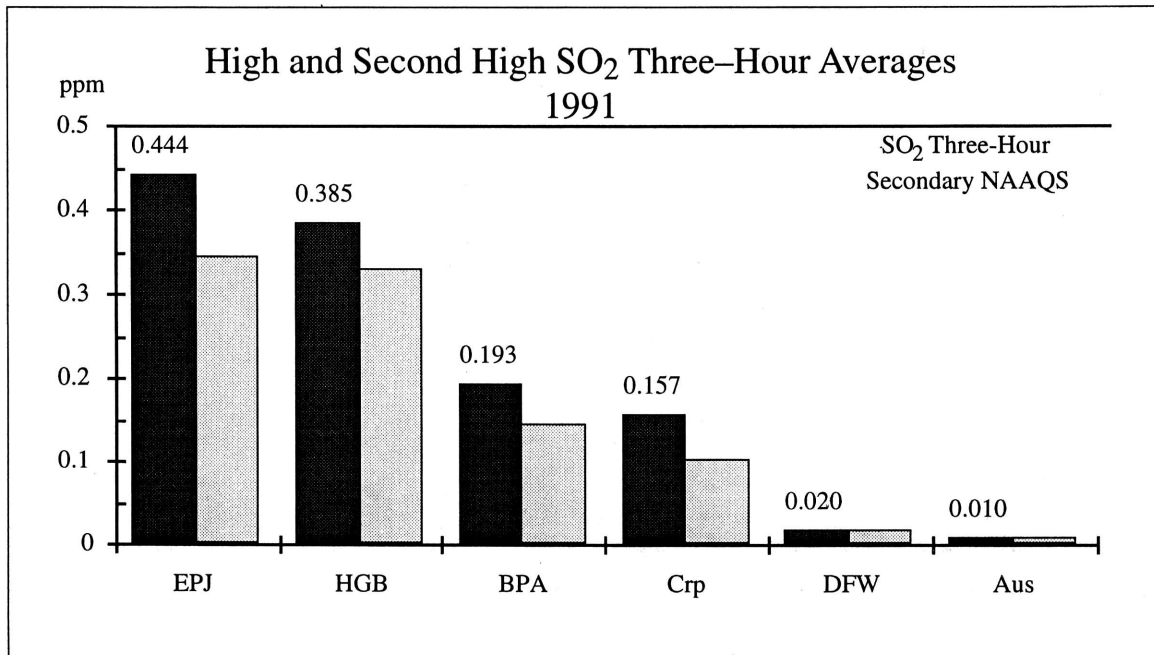
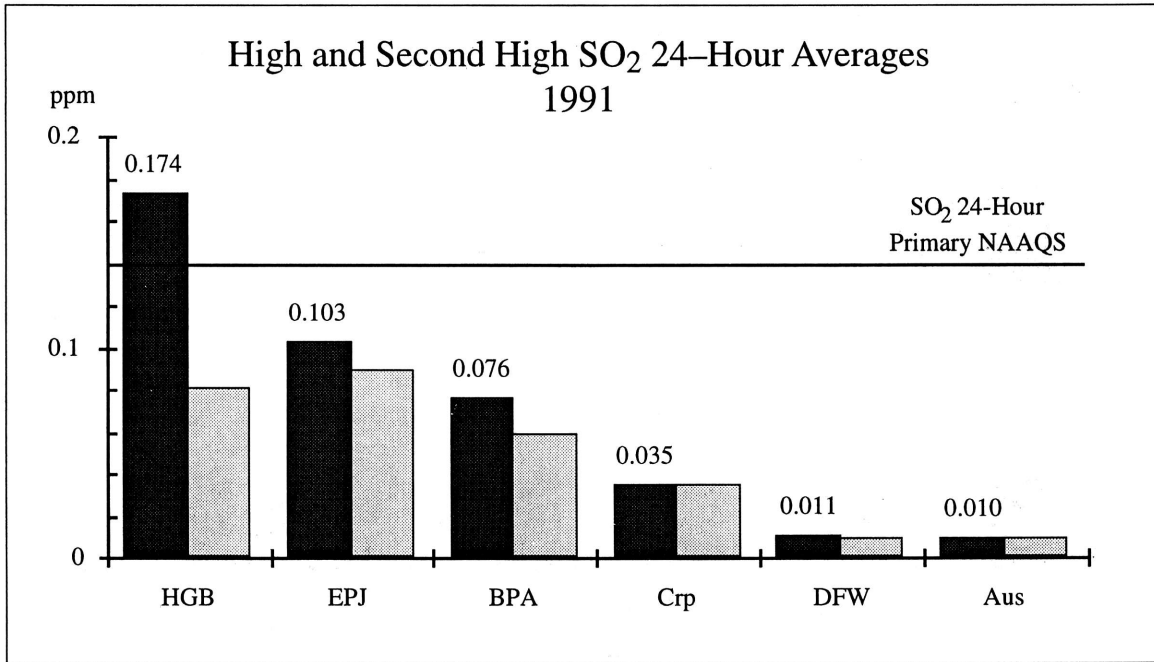
Comparisons by Metropolitan Area



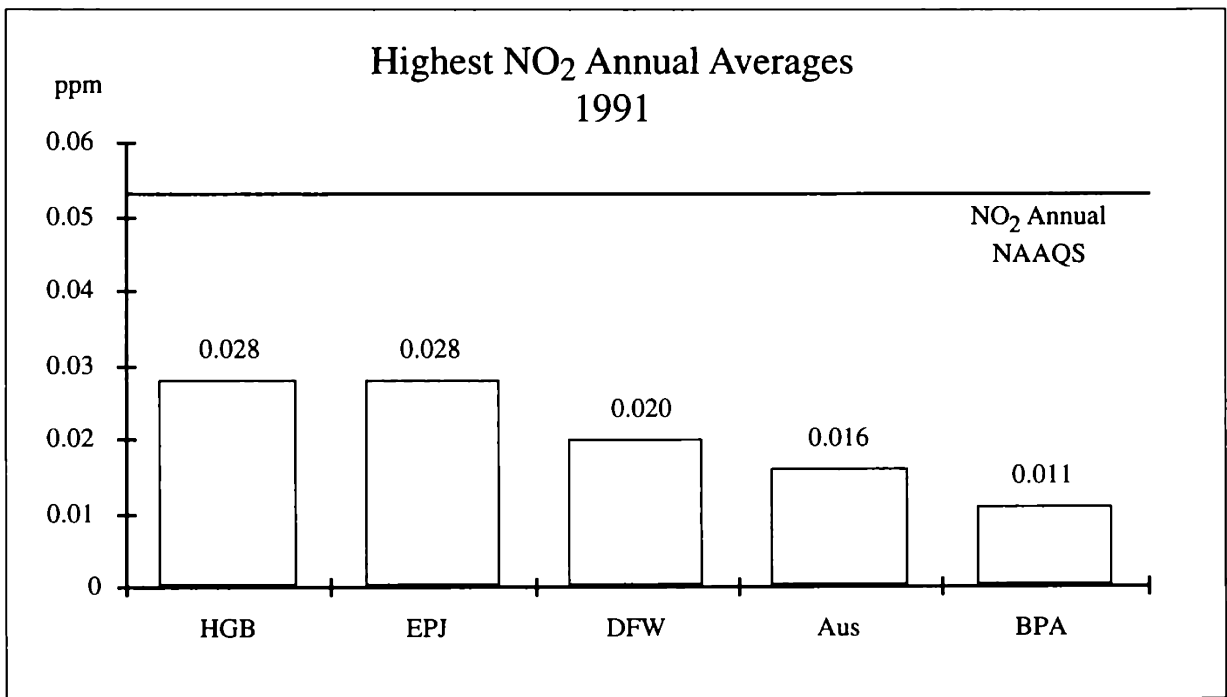
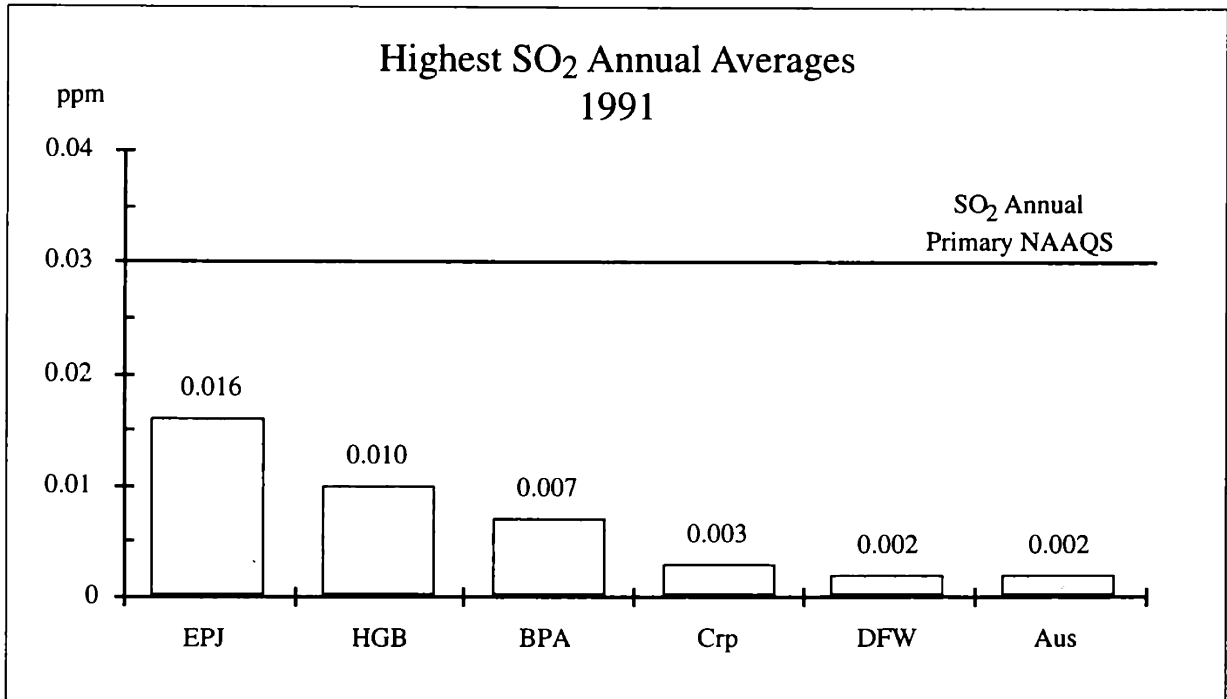
Comparisons by Metropolitan Area



Comparisons by Metropolitan Area



Comparisons by Metropolitan Area



Comparisons by Metropolitan Area

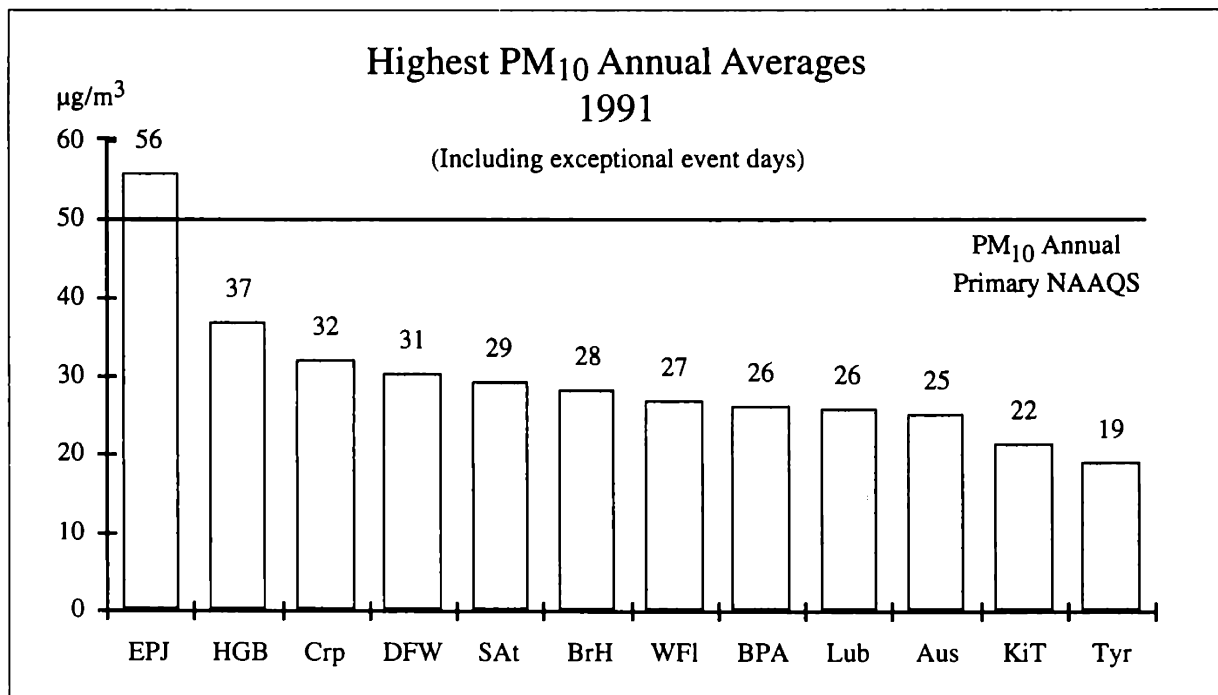
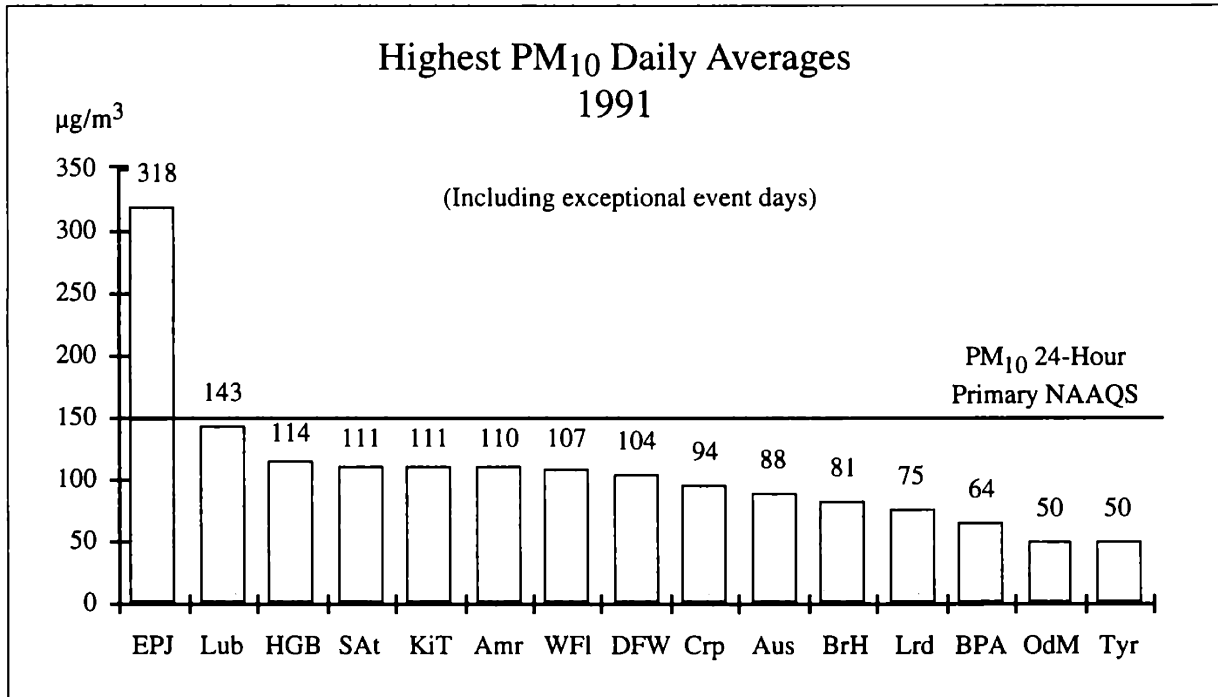


Table 2. 1991 Criteria Pollutant Summary by Monitoring Site

Location	O ₃		CO†		SO ₂ ‡		NO ₂	PM ₁₀			Lead		
	High Hr (ppm)	Exp Exc (days)	2nd Hr (ppm)	2nd 8-Hr (ppm)	2nd 24-Hr (ppm)	2nd 3-Hr (ppm)	Ann (ppm)	Ann (ppm)	High Day (µg/m ³)	Exp Exc (days)	Exp Ann (µg/m ³)	High Qtr (µg/m ³)	Exc Qtr
NAAQS	0.12	1.0	35	9	0.14	0.5	0.03	0.053	150	1.0	50	1.5	0
Amarillo MSA (Region 1)													
Amarillo									*110	*0.0	*27.0		
Austin-San Marcos MSA (Region 11)													
Downtown 32			3.4	3.3									
East									81	0.0	25.0		
North 25	0.11	0.0			*0.01	*0.01	*0.002	0.016					
Northwest 3	0.12	0.0											
Ridgetop									*88	*0.0	*22.0		
Beaumont-Port Arthur MSA (Region 10)													
Beaumont 2	0.20	6.0	3.6	2.2	0.08	0.16	0.007	0.006	64	0.0	26.0	0.03	0
Kountze 85	0.12	0.0											
Port Arthur 28	0.14	4.3			0.08	0.19	0.007						
SETRPC 40	0.15	+6.0						0.005					
SETRPC 41	0.18	+3.0						0.010					
SETRPC 42	0.12	+0.0						0.008					
SETRPC 43	0.16	+4.0						0.010					
West Orange 9	0.16	2.5						0.011					
Brazoria PMSA (Region 12)													
Clute 11	0.15	3.7											
Brownsville-Harlingen-San Benito MSA (Region 15)													
Brownsville									81	0.0	28.0		
San Benito									70	0.0	24.0		
Corpus Christi MSA (Region 14)													
Leopard									*77	*0.0	*30.0		
Navigation									94	0.0	32.0		
Tuloso 21	0.12	0.0			0.04	0.16	0.001						
West 4	0.11	0.0			0.02	0.07	0.003						
Dallas PMSA (Region 4)													
Bonnieview	0.10	0.0						0.011					
Boys Club									50	0.0	25.0	0.11	0
Coit									53	0.0	25.0		
Colony	0.09	0.0											
Convention									55	0.0	27.0	0.04	0
Dallas N 5	0.12	0.0						0.013				0.02	0
Douglas												0.03	0
Earhart												0.08	0
Ennis	0.11	0.0											
Ervay			3.9	3.8									
Farmers Branch												0.03	0
Frisco 1												0.11	0
Frisco 2												1.10	0
Frisco 3												0.67	0
Garland												0.10	0
Hinton	0.16	1.0	4.7	4.6	0.01	0.02	0.002	0.020					
Lancaster									55	0.0	23.0		
M.L. King												0.05	0
Midlothian 3									70	0.0	21.0		
Midlothian 4									84	0.0	21.0		
Morrell									104	0.0	31.0	0.19	0
Nolen												0.18	0
Palmer Paper												0.06	0
Rector												0.17	0
Sargent												0.14	0
Sunnyvale												0.02	0
Terrell	0.12	0.0											

† Running averages, truncated to tenths

‡ Block averages, rounded to hundredths

+ Number of actual exceedances, expected exceedances may be slightly higher

* Measurements for 1991 do not meet EPA completeness criteria

Table 2. 1991 Criteria Pollutant Summary by Monitoring Site

Location	O ₃		CO†		SO ₂ ‡			NO ₂	PM ₁₀			Lead	
	High Hr (ppm)	Exp Exc (days)	2nd Hr (ppm)	2nd 8-Hr (ppm)	2nd 24-Hr (ppm)	2nd 3-Hr (ppm)	Ann (ppm)	Ann (ppm)	High Day (µg/m ³)	Exp Exc (days)	Exp Ann (µg/m ³)	High Qtr (µg/m ³)	Exc Qtr
NAAQS	0.12	1.0	35	9	0.14	0.5	0.03	0.053	150	1.0	50	1.5	0
El Paso-Juarez Area TX NM MX (Region 6)													
Advance MX	*0.11	*0.0	11.0	9.4					*318	*12.3	*108		
Anthony NM									131	0.0	40		
Chamizal			11.3	11.1					138	0.0	28		
Downtown 6	0.12	0.0	10.7	9.7	0.05	0.22	0.011	0.028				0.23	0
East 30	0.15	3.2	8.9	8.0									
Ivanhoe			*10.6	*5.8					*51	*0.0	*23		
Kern					*0.04	*0.17	*0.008					0.25	0
La Union NM	0.10	0.0			0.02	0.10	0.003						
Lindbergh									66	0.0	23		
NE Clinic									84	0.0	22	0.15	0
Pestalozzi MX									*148	*0.0	*47		
Race Track NM													
Riverside									73	0.0	31		
Socorro									106	0.0	44		
Sunland NM					0.09	0.35	0.016		162	1.0	31		
Techno MX	0.13	1.3	*7.5	*6.6					*143	*0.0	*51		
Tillman			10.2	10.0					159	1.1	38	0.46	0
UTEP 12	0.14	2.0	7.4	6.4	0.07	0.36	0.009	0.018					
Vilas									110	0.0	46		
Zenco MX									219	2.4	56		
Fort Worth-Arlington PMSA (Region 4)													
Downtown 16			*4.5	*3.9								0.02	0
FAA									*53	*0.0	*21		
Geddes									*101	*0.0	*25		
Keller 17	0.17	4.2											
NW 13	0.15	6.7	3.8	3.3	0.01	0.02	0.001	0.014					
Worth Heights									73	0.0	25	0.02	0
Galveston-Texas City PMSA (Region 12)													
Fire Station									102	0.0	23		
Nessler Pool									*113	*0.0	*26		
Texas City 10	0.18	4.1			0.06	0.13	0.006		*44	*0.0	*21	0.02	0
Houston PMSA (Region 12)													
Aldine 8	0.17	10.6	7.0	6.9				0.016	*84	*0.0	*28		
Baytown 24					0.02	0.06	0.004						
Bingle									83	0.0	25	0.00	0
Clinton	0.18	13.4	5.1	4.7	0.04	0.14	0.006	0.023	*114	*0.0	*42	0.02	0
Crawford	0.18	5.1	5.2	5.0	0.03	0.08	0.004	0.028	103	0.0	30	*0.01	*0
Croquet	0.21	16.6			0.02	0.05	0.003						
Deer Park 18	0.15	7.4			0.02	0.05	0.002						
East 1	0.20	6.0	5.4	5.3	0.02	0.07	0.004	0.020	86	0.0	30	0.02	0
Fulton												0.01	0
Harris NW 26	0.13	1.1											
HRM 1	0.17	5.1	6.5	2.9	0.04	0.12	0.005	0.027	84				
HRM 3	0.22	9.2	7.9	4.1	0.08	0.33	0.010	0.021	75				
HRM 4	0.17	5.1	2.5	1.5	0.00	0.01	0.000	0.015					
HRM 7	0.21	15.2	4.5	2.2	0.02	0.06	0.001	0.020	86				
HRM 8	0.24	12.2	3.3	1.3	0.01	0.05	0.000	0.013					
HRM 10	0.17	6.2	1.8	1.0	0.00	0.01	0.000	0.007					
HRM 11	0.23	6.0	1.7	0.6	0.01	0.03	0.000	0.011					
Kress									109	0.0	37	0.03	0
Lang	0.16	5.2	7.6	7.4				0.022					
Manchester 22	0.20	13.6			*0.05	*0.13	*0.007						
Monroe	0.17	8.3			0.03	0.05	0.004		*104	*0.0	*29		
N Wayside	0.17	5.1			0.02	0.07	0.005						
Pasadena									*55	*0.0	*28		

† Running averages, truncated to tenths

‡ Block averages, rounded to hundredths

+ Number of actual exceedances, expected exceedances may be slightly higher

* Measurements for 1991 do not meet EPA completeness criteria

Table 2. 1991 Criteria Pollutant Summary by Monitoring Site

Location	O ₃		CO†		SO ₂ ‡		NO ₂		PM ₁₀			Lead	
	High Hr (ppm)	Exp Exc (days)	2nd Hr (ppm)	2nd 8-Hr (ppm)	2nd 24-Hr (ppm)	2nd 3-Hr (ppm)	Ann (ppm)	Ann (ppm)	High Day (µg/m ³)	Exp Exc (days)	Exp Ann (µg/m ³)	High Qtr (µg/m ³)	Exc Qtr
NAAQS	0.12	1.0	35	9	0.14	0.5	0.03	0.053	150	1.0	50	1.5	0
Killeen-Temple MSA (Region 9)													
Temple									111	0.0	22		
Laredo MSA (Region 15)													
Laredo									*75	*0.0	*39		
Longview-Marshall MSA (Region 5)													
Longview 19	*0.12	*0.0											
Lubbock MSA (Region 2)													
Lubbock									143	0.0	26		
Odessa-Midland MSA (Region 7)													
Odessa									*50	*0.0	*21		
San Antonio MSA (Region 13)													
Airport												0.02	0
Downtown 27			*3.9	*3.2									
East Kelly									*59	*0.0	*28		
ITC									111	0.0	29	0.03	0
North 7	0.11	0.0	4.5	3.4					74	0.0	21		
Northwest 23	0.11	0.0											
Tyler MSA (Region 5)													
Tyler									50	0.0	19		
Wichita Falls MSA (Region 3)													
Wichita Falls									107	0.0	27		
Victoria MSA (Region 14)													
Victoria 87	*0.10	*0.0											

† Running averages, truncated to tenths

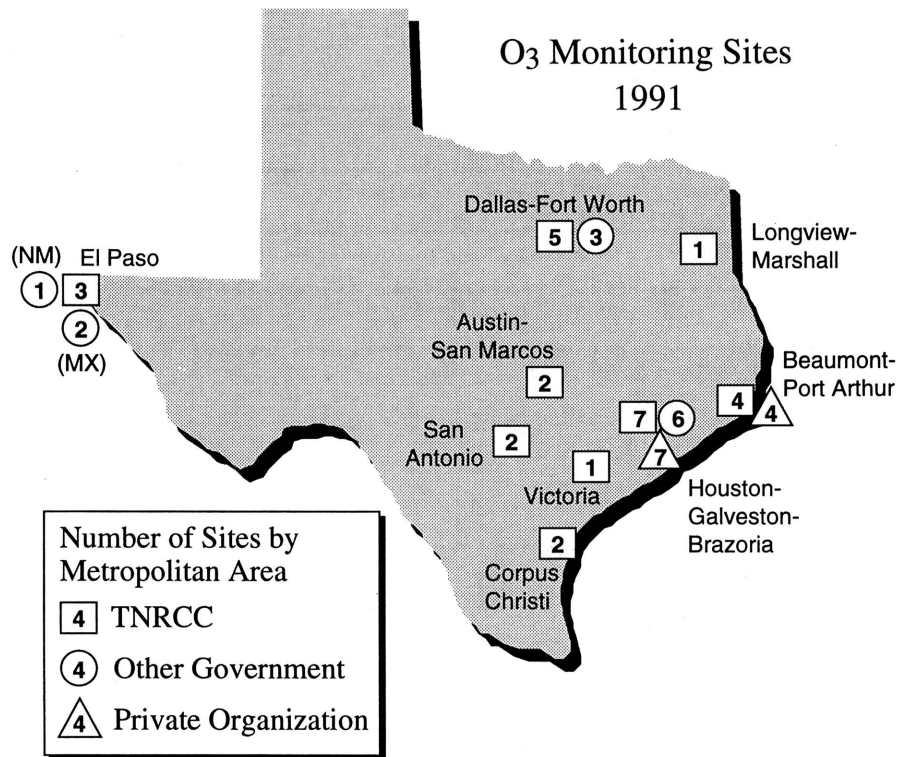
‡ Block averages, rounded to hundredths

+ Number of actual exceedances, expected exceedances may be slightly higher

* Measurements for 1991 do not meet EPA completeness criteria

OZONE (O₃)

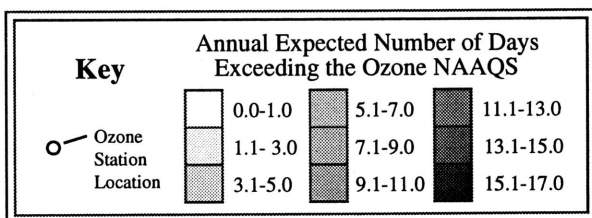
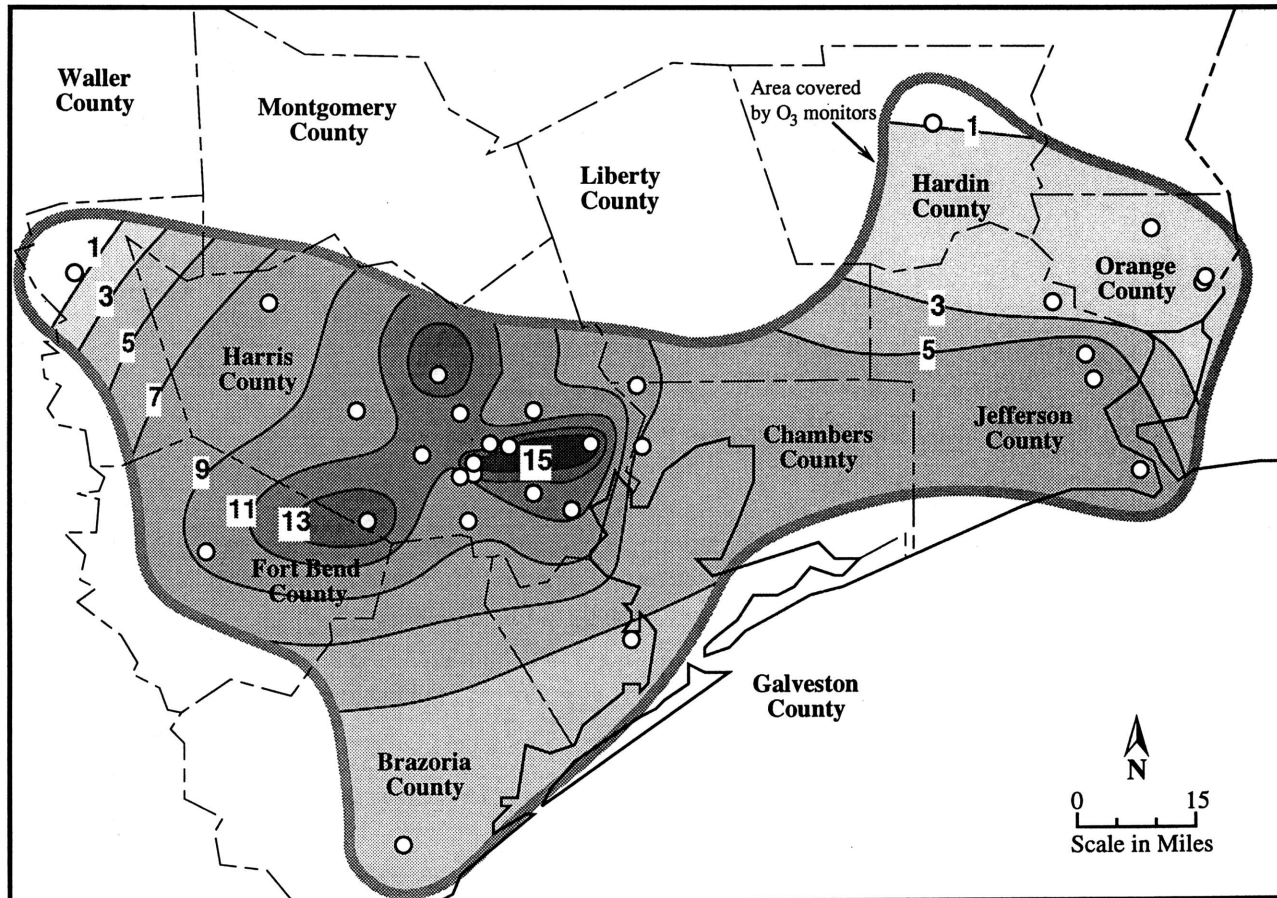
During 1991, the TNRCC, local government, and private networks continuously monitored O₃ at 47 sites in Texas. The map at right shows the distribution of O₃ monitors in Texas by metropolitan area. Unlike other gaseous pollutants, O₃ is not emitted directly into the atmosphere. Instead, it is created in the atmosphere by the action of sunlight on volatile organic compounds and nitrogen oxides. Higher levels of O₃ usually occur on sunny days with light wind speeds, primarily during the months of March through October. An O₃ exceedance day is counted if the peak one-hour average exceeds the NAAQS. Then, the expected exceedance days are determined from the actual number of measured exceedances with adjustments to account for missing data according to EPA guidelines. In order to demonstrate attainment of the NAAQS, the average annual number of expected exceedances must not exceed 1.0 day per year over a three-year period.



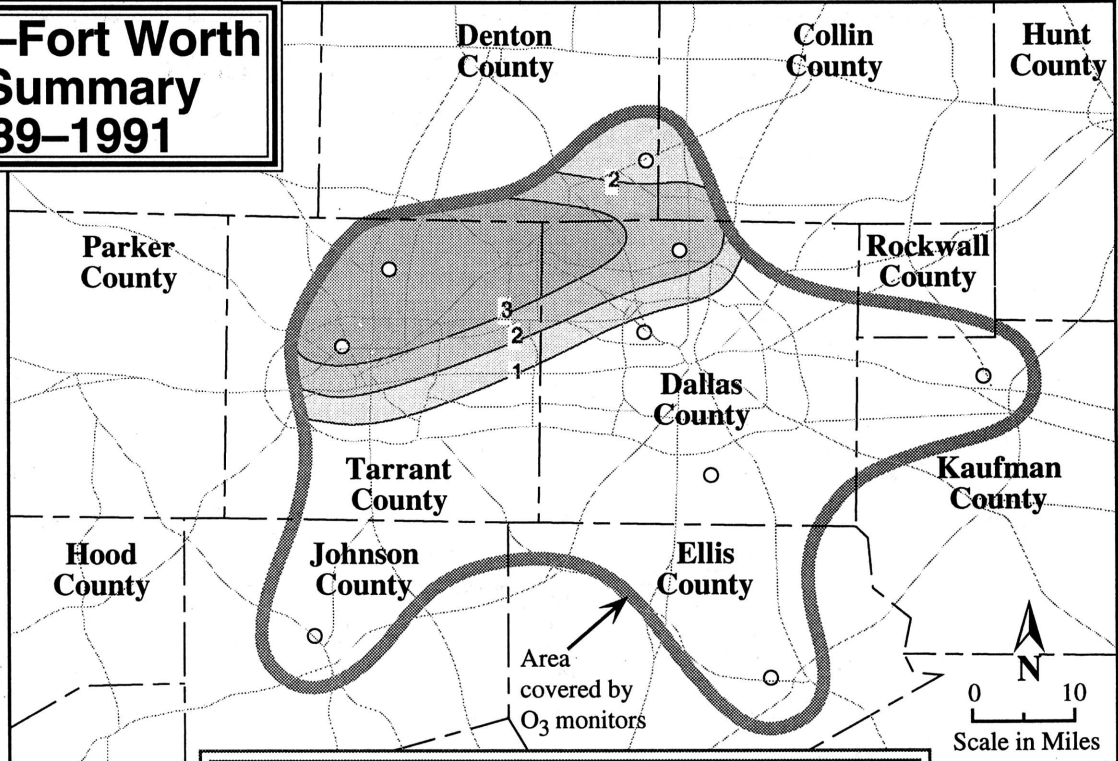
An O₃ exceedance day is counted if the peak one-hour average exceeds the NAAQS. Then, the expected exceedance days are determined from the actual number of measured exceedances with adjustments to account for missing data according to EPA guidelines. In order to demonstrate attainment of the NAAQS, the average annual number of expected exceedances must not exceed 1.0 day per year over a three-year period.

Maps on the next two pages show the distribution of the number of expected O₃ exceedances for 1989–1991 for the Houston, Dallas–Fort Worth, and El Paso areas. Table 3 provides a summary of O₃ measurements for 1991 and expected exceedances for 1989–1991. The listings include all of the TNRCC and local governmental agency monitoring sites. The sites are grouped by metropolitan area, and the metropolitan areas are listed in order of the highest measured one-hour concentration. For metropolitan areas with more than one monitoring site, the sites are listed in order of the highest one-hour concentration. The Aerometric Information Retrieval System (AIRS) code for each site location is listed along with the site name. The percent completeness shown in this table is based on the ozone season and indicates the percentage of the ozone season for which valid data were obtained according to EPA guidelines.

Southeast Texas O₃ Summary 1989-1991



**Dallas-Fort Worth
O₃ Summary
1989-1991**

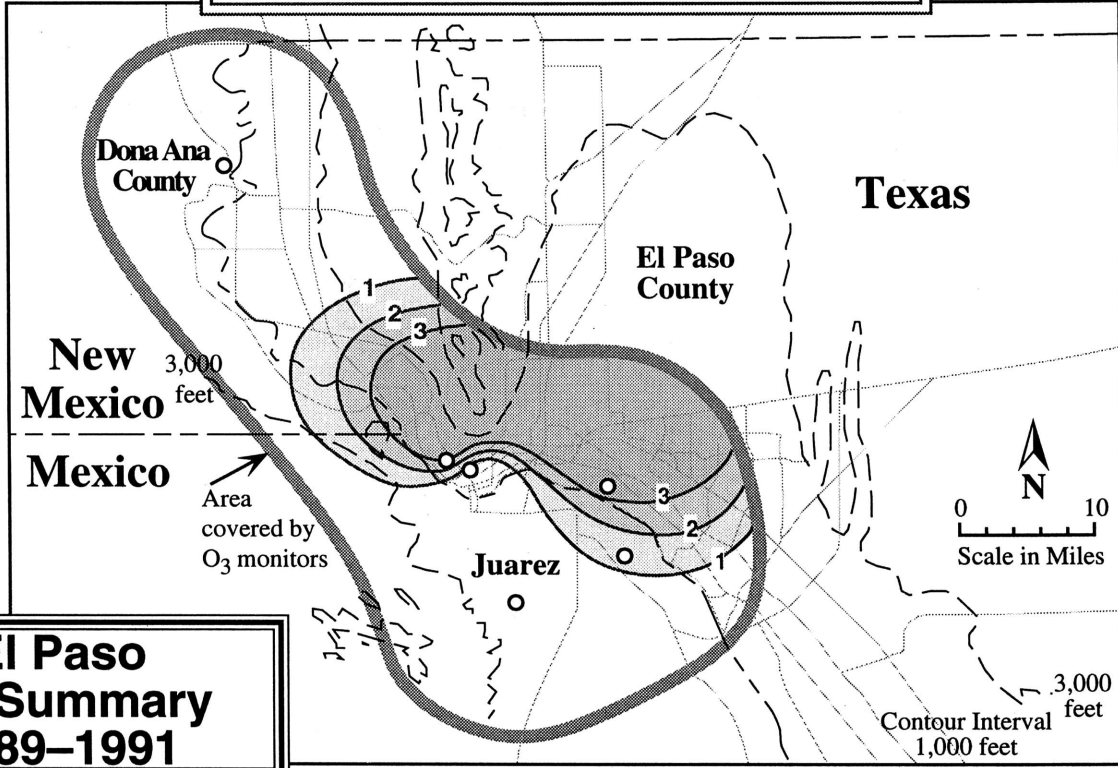


Key

Annual Expected Number of Days Exceeding the Ozone NAAQS

	0.0-1.0		3.1-4.0		6.1-7.0
	1.1-2.0		4.1-5.0		7.1-8.0
	2.1-3.0		5.1-6.0		8.1-9.0

Ozone Station Location



**El Paso
O₃ Summary
1989-1991**

Table 3. Ozone Summary 1991

AIRS	Site Name	1-Hr High (ppm)	1-Hr 2nd Day (ppm)	Exp Exc (days/yr)	Exp Exc 1989-91 (days/yr)	† Comp (%)
NAAQS		#0.12			#1.0	
Austin-San Marcos MSA (Region 11)						
4530014S	Austin NW 3	0.120	0.100	0.0	0.0	97
4530003S	Austin N 25	0.110	0.100	0.0	0.0	89
Beaumont-Port Arthur MSA (Region 10)						
2450009S	Beaumont 2	0.200	0.130	6.0	2.4	100
3610100P	SETRPC 41	0.181	0.131	+3.0	*+2.5	‡
2450102P	SETRPC 43	0.163	0.143	+4.0	*+6.0	‡
3611001S	West Orange 9	0.160	0.130	2.5	*2.5	79
2450101P	SETRPC 40	0.146	0.144	+6.0	*+6.5	‡
2450011S	Port Arthur 28	0.140	0.130	4.3	5.1	93
1990002S	Kountze 85	0.120	0.110	0.0	1.1	91
3611100P	SETRPC 42	0.117	0.107	+0.0	*+2.0	‡
Corpus Christi MSA (Region 14)						
3550025S	West 4	0.120	0.110	0.0	0.3	96
3550026S	Tuloso 21	0.110	0.100	0.0	0.0	90
Dallas-Fort Worth CMSA (Region 4)						
4392003S	Keller 17	0.170	0.150	4.2	3.5	94
1130069L	Hinton	0.160	0.120	1.0	0.7	98
4391002S	Ft Worth NW 13	0.150	0.140	6.7	3.3	90
1130045S	Dallas N 5	0.120	0.110	0.0	2.5	88
2570001S	Terrell 83	0.120	0.110	0.0	**0.0	100
1390084S	Ennis 84	0.110	0.100	0.0	**0.0	98
1130055L	Bonnieview	0.100	0.100	0.0	0.0	99
1210054L	Colony	0.090	0.080	0.0	1.7	93
El Paso-Juarez Area TX NM MX (Region 6)						
1410028S	East 30	0.150	0.130	3.2	3.5	94
1410037S	UTEP 12	0.140	0.130	2.0	3.1	98
0060001L	Techno MX	0.127	0.119	1.3	**1.3	79
1410027S	Downtown 6	0.120	0.100	0.0	0.7	97
0060004L	Advance MX	0.111	0.106	*	***	64
0130008S	La Union NM	0.099	0.098	0.0	0.0	99
Houston-Galveston-Brazoria CMSA (Region 12)						
2010808P	HRM 8	0.240	0.156	12.2	11.1	99
0710901P	HRM 11	0.234	0.202	6.0	6.3	100
2010803P	HRM 3	0.216	0.190	9.2	15.4	98
2010051L	Croquet	0.209	0.200	16.6	14.8	96
2010807P	HRM 7	0.205	0.201	15.2	17.4	99
2010059S	Manchester 22	0.200	0.200	13.6	9.5	81
2011034S	Houston East 1	0.200	0.180	6.0	11.3	100
2011035L	Clinton	0.180	0.180	13.4	15.0	97
1671002S	Texas City 10	0.180	0.150	4.1	4.7	97
2011037L	Crawford	0.175	0.170	5.1	11.3	97
2010024S	Aldine 8	0.170	0.170	10.6	14.8	85
2010801P	HRM 1	0.170	0.161	5.1	12.8	98
2010062L	Monroe	0.170	0.158	8.6	9.3	97
2010046L	N Wayside	0.170	0.156	5.1	12.0	99
2010804P	HRM 4	0.166	0.162	5.1	9.4	99
0710900P	HRM 10	0.165	0.150	6.2	8.3	97
2010047L	Lang	0.158	0.151	5.2	9.9	96
2011003S	Deer Park 18	0.150	0.150	7.4	11.5	81
0391003S	Clute 11	0.150	0.130	3.7	**3.7	82
2010029S	Harris NW 26	0.130	0.120	1.1	8.1	93
Longview-Marshall MSA (Region 5)						
1830001S	Longview 19	0.120	0.110	*	*1.2	63
San Antonio MSA (Region 13)						
0290036S	North 7	0.110	0.110	0.0	0.0	94
0290032S	Northwest 23	0.110	0.100	0.0	0.0	78
Victoria MSA (Region 14)						
4690003S	Victoria 87	0.103	0.100	*	***	52

S State monitoring site (added to end of AIRS site number)

L Local governmental agency monitoring site (added to end of AIRS site number)

P Private monitoring site (added to end of AIRS site number)

† Based on complete days during ozone season according to EPA convention

+ Number of actual exceedances; expected exceedances may be slightly higher

‡ Data not available

Expected number of days with highest one-hour concentration over 0.12 ppm — annual average not to exceed 1.0 day per year over a three-year period

* Each * indicates one year not meeting EPA completeness criteria; not valid for NAAQS comparison

CARBON MONOXIDE (CO)

CO is produced by the incomplete combustion of carbon-containing fuels, most notably by automotive engine and power plants. During 1991, CO was continuously monitored at 26 sites in Texas as displayed in the adjacent map. Two NAAQS have been established for CO. One is for an eight-hour average of 9 ppm and the second is for a one-hour average of 35 ppm, each not to be exceeded more than once during a calendar year. The eight-hour NAAQS has been exceeded periodically in El Paso during the winter months when very stable atmospheric conditions exist. The one-hour NAAQS has never been exceeded in Texas.

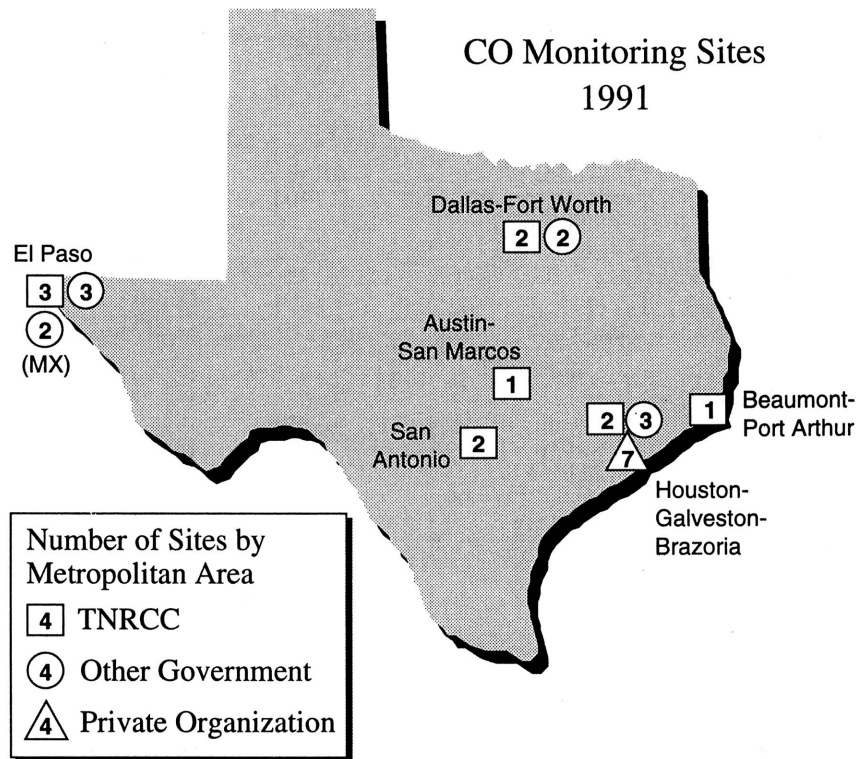


Table 4 provides a summary of CO measurements during 1991. The table listings are grouped by metropolitan area and sorted in descending order from the highest eight-hour average.

Table 4. CO Summary 1991

AIRS	Site Name	@ 8-Hr			1-Hr			Comp (%)
		High (ppm)	2nd (ppm)	Exc (#)	High (ppm)	2nd (ppm)	Exc (#)	
NAAQS			9			35		
Austin-San Marcos MSA (Region 11)								
4530017S	Downtown 32	3.4	3.3	0	7.2	7.0	0	75
Beaumont-Port Arthur MSA (Region 10)								
2450009S	Beaumont 2	3.6	2.2	0	7.0	6.7	0	92
Dallas-Fort Worth CMSA (Region 4)								
1130069L	Dallas Hinton	4.7	4.6	0	6.0	5.9	0	93
4391003S	Ft Worth Dtn 16	4.5	3.9	0	5.9	5.6	0	73
1130053L	Dallas Ervay	3.9	3.8	0	8.6	8.1	0	95
4391002S	Ft Worth NW 13	3.8	3.3	0	5.4	5.3	0	91
El Paso-Juarez Area TX NM MX (Region 6)								
1410044L	Chamizal	11.3	11.1	3	17.4	17.0	0	93
0060004L	Advance MX	11.0	9.4	1	19.0	18.6	0	92
1410027S	Downtown 6	10.7	9.7	2	17.3	14.8	0	91
1410002L	Tillman	10.2	10.0	2	17.0	16.4	0	95
1410028S	East 30	8.9	8.0	0	15.3	12.6	0	87
0060001L	Techno MX	7.5	6.6	0	13.3	13.3	0	74
1410037S	UTEP 12	7.4	6.4	0	11.4	10.4	0	90
1410029L	Ivanhoe	6.0	5.8	0	11.1	10.6	0	66
Houston-Galveston-Brazoria CMSA (Region 12)								
2010047L	Lang	7.6	7.4	0	11.5	11.4	0	93
2010024S	Aldine 8	7.0	6.9	0	9.0	8.3	0	86
2010803P	HRM 3	6.1	4.1	0	8.6	7.9	0	96
2011034S	East 1	5.4	5.3	0	10.6	10.3	0	91
2011037L	Crawford	5.2	5.0	0	8.5	8.4	0	94
2011035L	Clinton	5.1	4.7	0	6.6	6.4	0	94
2010801P	HRM 1	4.5	2.9	0	7.4	6.5	0	96
2010807P	HRM 7	2.5	2.2	0	4.6	4.5	0	98
2010804P	HRM 4	1.7	1.5	0	2.5	2.5	0	98
2010808P	HRM 8	1.3	1.3	0	4.2	3.3	0	98
0710900P	HRM 10	1.1	1.0	0	1.9	1.8	0	97
0710901P	HRM 11	0.9	0.6	0	1.8	1.7	0	99

S State monitoring site (added to end of AIRS site number)

L Local governmental agency monitoring site (added to end of AIRS site number)

@ Running average, truncated to tenths

Number of exceedances

Note: CO eight-hour average must round to 10 ppm or greater to be counted as an excursion. Two excursions per year are required to violate the NAAQS.

SULFUR DIOXIDE (SO₂)

SO₂ is produced by the burning of sulfur-containing fuels, from the smelting of metallic ores containing sulfur, and in the process of removing sulfur from fuels. SO₂ was monitored continuously at 27 TNRCC, local government, and private sites in Texas during 1991 as shown in the adjacent map. The short-term NAAQS for SO₂ is 0.14 ppm for a 24-hour average not to be exceeded more than once per year. The long-term NAAQS is 0.03 ppm for a calendar year average. There is also a secondary NAAQS of 0.5 ppm for a three-hour average that is intended to protect public welfare from any known or anticipated adverse effects

of the pollutant at the specified level. The Houston, Beaumont-Port Arthur, El Paso, and Galveston-Texas City areas have historically shown the highest measured SO₂ levels in the state.

Table 5 shows a summary of SO₂ measurements during 1991. The table listings are grouped by metropolitan area and sorted in descending order from the highest three-hour average.

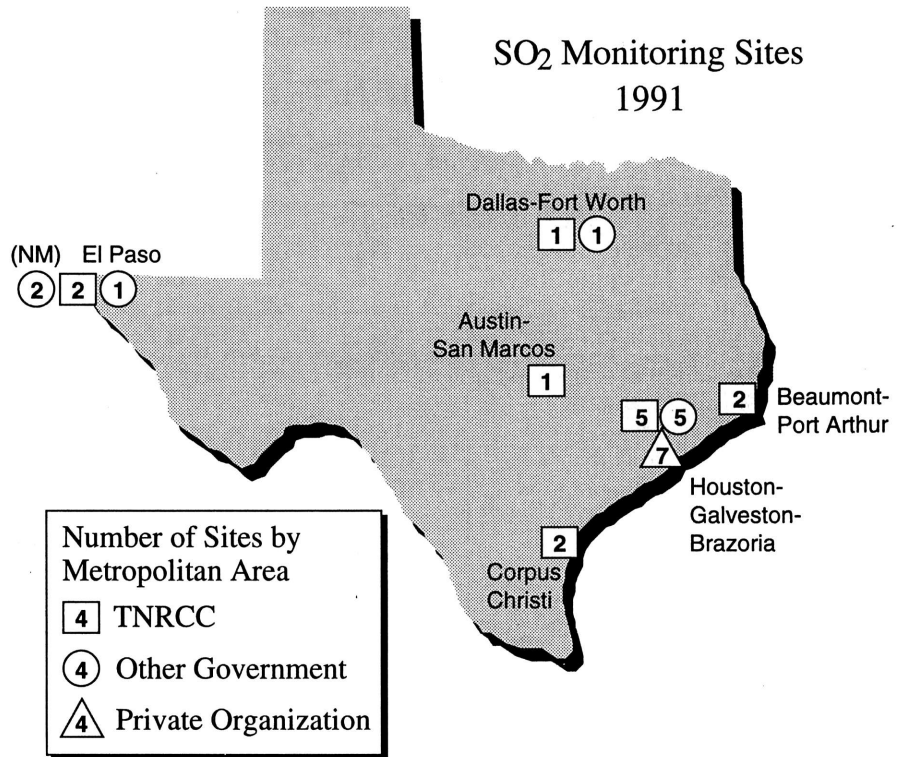


Table 5. SO₂ Summary 1991

AIRS	Site Name	‡ 3-Hr			‡ 24-Hr			Annual	Comp
		High (ppm)	2nd (ppm)	Exc (#)	High (ppm)	2nd (ppm)	Exc (#)	Average (ppm)	(%)
NAAQS		0.5			0.14			0.03	
Austin-San Marcos MSA (Region 11)									
4530014S	Austin NW 3	0.010	0.010	0	0.010	0.010	0	*0.002	15
Beaumont-Port Arthur MSA (Region 10)									
2450011S	Port Arthur 28	0.193	0.147	0	0.076	0.059	0	0.007	89
2450009S	Beaumont 2	0.160	0.117	0	0.076	0.059	0	0.007	94
Corpus Christi MSA (Region 14)									
3550025S	West 4	0.157	0.103	0	0.035	0.035	0	0.001	91
3550026S	Tuloso 21	0.073	0.060	0	0.023	0.018	0	0.003	87
Dallas-Fort Worth CMSA (Region 4)									
1130069L	Hinton	0.020	0.020	0	0.011	0.010	0	0.002	93
4391002S	Ft Worth NW 13	0.017	0.013	0	0.007	0.006	0	0.001	89
El Paso-Juarez Area TX NM MX (Region 6)									
0130017S	Sunland NM	0.444	0.347	0	0.103	0.090	0	0.016	99
1410037S	UTEP 12	0.357	0.290	0	0.071	0.055	0	0.009	84
1410027S	Downtown 6	0.223	0.220	0	0.047	0.046	0	*0.011	72
1410033L	Kern	0.170	0.160	0	0.041	0.037	0	*0.008	64
0130008S	La Union NM	0.116	0.097	0	0.021	0.020	0	0.003	99
Houston-Galveston-Brazoria CMSA (Region 12)									
2010803P	HRM 3	0.385	0.332	0	0.174	0.081	1	0.010	96
2010801P	HRM 1	0.189	0.124	0	0.074	0.037	0	0.005	96
2011035L	Clinton	0.137	0.080	0	0.036	0.030	0	0.006	93
2010059S	Manchester 22	0.130	0.117	0	0.049	0.047	0	*0.007	74
1671002S	Texas City 10	0.127	0.097	0	0.055	0.050	0	0.006	91
2011037L	Crawford	0.080	0.070	0	0.028	0.023	0	0.004	85
2011034S	East 1	0.073	0.060	0	0.021	0.020	0	0.004	87
2010046L	N Wayside	0.067	0.040	0	0.021	0.017	0	0.005	89
2010808P	HRM 8	0.065	0.051	0	0.014	0.007	0	0.000	98
2010807P	HRM 7	0.062	0.058	0	0.030	0.020	0	0.001	98
2010004S	Baytown 24	0.060	0.043	0	0.024	0.021	0	0.004	81
2010062L	Monroe	0.053	0.047	0	0.026	0.025	0	0.004	90
2011003S	Deer Park 18	0.053	0.030	0	0.015	0.015	0	0.002	79
2010051L	Croquet	0.047	0.043	0	0.018	0.017	0	0.003	91
0710901P	HRM 11	0.037	0.026	0	0.007	0.006	0	0.000	99
2010804P	HRM 4	0.019	0.013	0	0.005	0.003	0	0.000	98
0710900P	HRM 10	0.013	0.010	0	0.002	0.001	0	0.000	99

- S State monitoring site (added to end of AIRS site number)
- L Local governmental agency monitoring site (added to end of AIRS site number)
- ‡ Block averages, rounded to hundredths
- # Number of exceedances; must be 2 or more to violate the NAAQS
- * Less than 75% completeness; not valid for NAAQS comparison

NITROGEN DIOXIDE (NO₂)

Although there are several oxides of nitrogen produced by high temperature fuel combustion in air, the only NAAQS is for an annual arithmetic average of 0.053 ppm for NO₂. This annual standard has never been exceeded in Texas. In fact, only in Houston and El Paso has the annual average been as high as 0.03 ppm during the past five years. Continuous NO₂ monitors were operated by the TNRCC, local government, and private organizations at 25 sites in the Austin, Beaumont–Port Arthur, Dallas–Fort Worth, El Paso, and Houston areas during 1991, as shown in the adjacent map.

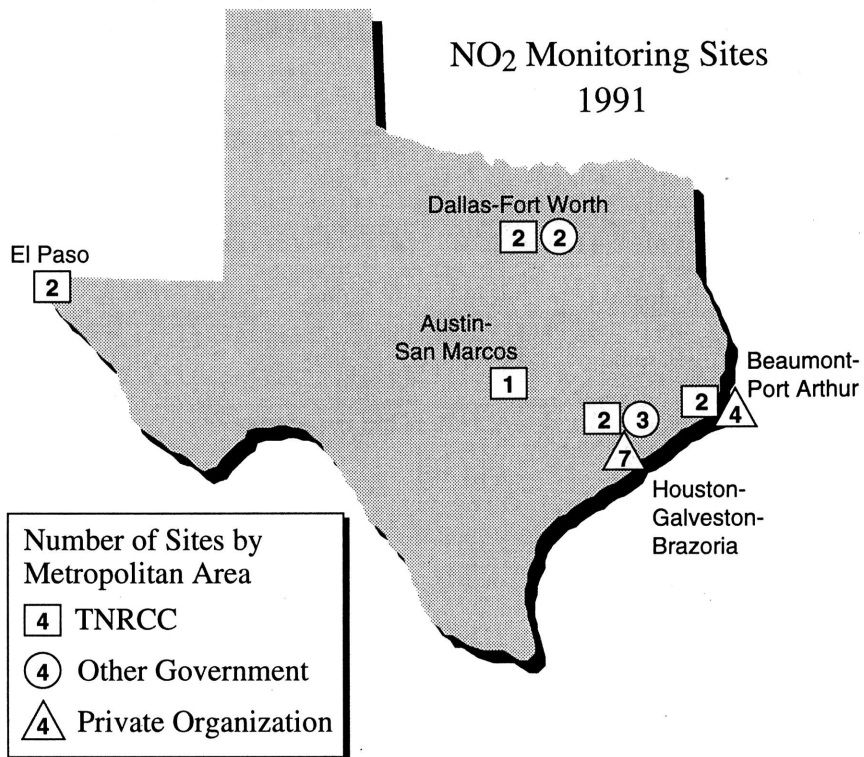


Table 6 shows a summary of NO₂ measurements during 1991. The table listings are grouped by metropolitan areas and sorted in descending order from the highest one-hour average.

Table 6. NO₂ Summary 1991

AIRS	Site Name	1-Hr		Annual	Comp (%)
		High (ppm)	2nd (ppm)	Average (ppm)	
NAAQS				0.053	
Austin-San Marcos MSA (Region 11)					
4530017S	Downtown 32	0.07	0.07	0.016	88
Beaumont-Port Arthur MSA (Region 10)					
3610100P	SETRPC 41	0.08	0.07	0.010	98
2450101P	SETRPC 40	0.07	0.07	0.005	96
3611001S	West Orange 9	0.07	0.06	0.011	75
2450102P	SETRPC 43	0.07	0.06	0.010	97
2450009S	Beaumont 2	0.06	0.06	0.006	92
3611100P	SETRPC 42	0.05	0.05	0.008	98
Dallas-Fort Worth CMSA (Region 4)					
1130069L	Hinton	0.11	0.11	0.020	91
1130045S	Dallas N 5	0.08	0.08	0.013	89
1130055L	Bonnieview	0.06	0.05	0.011	94
4391002S	Ft Worth NW 13	0.08	0.08	0.014	82
El Paso-Juarez Area TX NM MX (Region 6)					
1410027S	Downtown 6	0.12	0.11	0.028	90
1410037S	UTEP 12	0.11	0.11	0.018	86
Houston-Galveston-Brazoria CMSA (Region 12)					
2010801P	HRM 1	0.23	0.15	0.027	95
2010804P	HRM 4	0.17	0.12	0.015	97
2010803P	HRM 3	0.13	0.10	0.021	96
0710901P	HRM 11	0.12	0.12	0.011	98
2011037L	Crawford	0.12	0.12	0.028	86
2011035L	Clinton	0.12	0.11	*0.023	72
2010047L	Lang	0.11	0.11	*0.022	75
2011034S	East 1	0.10	0.10	0.020	91
2010807P	HRM 7	0.10	0.08	0.020	98
2010024S	Aldine 8	0.08	0.08	0.016	80
2010808P	HRM 8	0.08	0.07	0.013	98
0710900P	HRM 10	0.07	0.07	0.007	98

S State monitoring site (added to end of AIRS site number)

L Local governmental agency monitoring site (added to end of AIRS site number)

* Less than 75% completeness; not valid for NAAQS comparison

PARTICULATE MATTER OF TEN MICRONS OR LESS (PM₁₀)

Particulate matter in the atmosphere is produced by a wide variety of natural and man-made sources. It includes both solid and liquid particles, except for water or ice, that can be emitted directly into the air or formed by chemical reactions in the atmosphere. Particles below about 10 microns in size are more likely to be deposited deep in the lungs, where they present the most direct health concern. The NAAQS for PM₁₀ is 150 µg/m³ for a 24-hour sample, not to be exceeded on more than three days over a three-year period and 50 µg/m³ for an annual arithmetic mean. During 1991, PM₁₀ was monitored by the TNRCC,

local government, and private organizations at 51 sites in Texas. The sampling schedules are either daily, every other day, or every sixth day, depending on the expected probability of the site exceeding the NAAQS. A PM₁₀ exceedance day is counted if the 24-hour average exceeds the NAAQS. Then, the expected exceedance days are determined from the actual number of measured exceedances with adjustments to account for missing data according to EPA guidelines. In order to demonstrate attainment of the NAAQS, the average annual number of expected exceedances must not exceed 1.0 day per year over a three-year period.

Table 7 provides a summary of the 1991 PM₁₀ measurements at each monitoring site. The table listings are grouped by metropolitan area and sorted in descending order from the highest 24-hour average.

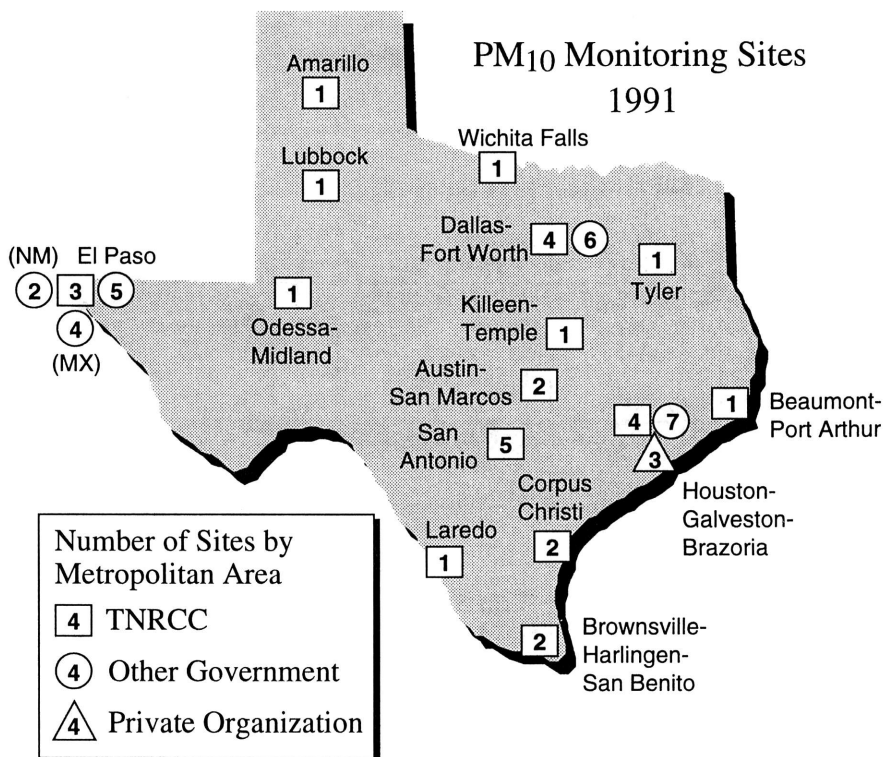


Table 7. PM₁₀ Summary 1991

AIRS	Site Name	24-Hr High ($\mu\text{g}/\text{m}^3$)	Exp Exc (days/yr)	Exp Exc 1989-91 (days/yr)	Annual Mean ($\mu\text{g}/\text{m}^3$)	Samples	Comp (%)	Valid Qtrs
NAAQS		#150	#1.0		50			
Amarillo MSA (Region 1)								
3750004S	Amarillo	110	*0.0	***	*27.2	51	85	2
Austin-San Marcos MSA (Region 11)								
4530010S	Ridgetop	88	*0.0	*0.0	*22.2	47	78	3
4530016S	East Austin	81	0.0	*0.0	25.4	60	81	4
Beaumont-Port Arthur MSA (Region 10)								
2450009S	Beaumont 2	64	0.0	**0.0	26.4	55	92	4
Brownsville-Harlingen-San Benito MSA (Region 15)								
0610004S	Brownsville	81	0.0	*0.0	28.4	55	92	4
0612002S	San Benito	70	0.0	**0.0	23.9	58	97	4
Corpus Christi MSA (Region 14)								
3550020S	Navigation	94	0.0	0.0	32.1	69	93	4
3550012S	Leopard	77	*0.0	*0.0	*30.4	54	90	3
Dallas-Fort Worth CMSA (Region 4)								
1130018L	Morrell	104	0.0	0.0	30.5	72	100	4
4390060L	Geddes	101	*0.0	**0.0	*24.9	51	85	3
1390004S	Midlothian 4	84	0.0	**0.0	20.9	55	92	4
4390023S	Worth Hgts	73	0.0	0.0	25.1	60	100	4
1390003S	Midlothian 3	70	0.0	**0.0	21.4	53	88	4
1130050L	Convention	55	0.0	**0.0	27.0	56	93	4
1130020L	Lancaster	55	0.0	0.0	22.6	58	97	4
4390029L	FAA	53	*0.0	**0.0	*20.5	36	60	1
1130035L	Coit	53	0.0	0.0	24.8	58	97	4
1130057S	Boys Club	50	0.0	*0.0	24.7	54	90	4
El Paso-Juarez Area TX NM MX (Region 6)								
0060004L	Advance MX	318	*12.3	***	*107.9	54	90	3
0060003L	Zenco MX	219	2.4	**2.4	55.7	54	90	4
0130017S	Sunland NM	162	1.0	*1.6	30.8	357	98	4
1410002L	Tillman	159	1.1	4.4	38.3	336	92	4
0060002L	Pestalozzi MX	148	*0.0	***	*46.6	52	87	3
0060001L	Techno MX	143	*0.0	*0.0	*50.6	40	67	1
1410044L	Chamizal	138	0.0	**0.0	27.5	330	90	4
0130016S	Anthony NM	131	0.0	1.7	40.1	182	99	4
1410041S	Vilas	110	0.0	3.7	45.7	57	95	4
1410043S	Socorro	106	0.0	**0.0	44.1	58	97	4
1410010L	NE Clinic	84	0.0	*0.0	22.0	60	100	4
1410038L	Riverside	73	0.0	*0.0	31.2	58	97	4
1410045S	Lindbergh	66	0.0	0.0	23.0	57	95	4
1410029L	Ivanhoe	51	*0.0	*0.0	*22.5	42	70	2
Houston-Galveston-Brazoria CMSA (Region 12)								
2011035L	Clinton	114	*0.0	***	*42.2	154	85	3
1670053L	Tx City Nessler	113	*0.0	***	*26.0	43	72	2
2010054L	Kress	109	0.0	**0.0	36.8	56	93	4
2010062L	Monroe	104	*0.0	**0.0	*28.6	51	85	3
2011037L	Crawford	103	0.0	*0.0	29.8	55	92	4
1670004L	Tx City Fire Sta	102	0.0	**0.0	22.8	56	93	4
2011034S	East 1	86	0.0	*0.0	29.7	58	97	4
2010807P	HRM 7	86	†	†	22.0	†	†	†
2010024S	Aldine 8	84	*0.0	***	*28.0	46	77	1
2010801P	HRM 1	84	†	†	31.0	†	†	†
2010045L	Bingle	83	0.0	**0.0	25.1	53	88	4
2010803P	HRM 3	75	†	†	26.0	†	†	†
2015002S	Pasadena	55	*0.0	***	*27.8	42	70	2
1671002S	Texas City 10	44	*0.0	***	*20.8	44	73	3
Killeen-Temple MSA (Region 9)								
0270001S	Temple	111	0.0	**0.0	21.5	57	95	4
Laredo MSA (Region 15)								
4790015S	Laredo	75	*0.0	***	*38.9	51	85	3
Lubbock MSA (Region 2)								
3030001S	Lubbock	143	0.0	0.7	26.0	171	94	4
Odessa-Midland MSA (Region 7)								
1350002S	Odessa	50	*0.0	***	*21.4	35	58	2
San Antonio MSA (Region 13)								
0290034S	ITC	111	0.0	0.0	29.2	53	88	4
0910003S	New Braunfels 3	85	*0.0	***	*22.7	52	87	3
0290036S	North 7	74	0.0	*0.0	20.6	56	93	4
0290042S	East Kelly	59	*0.0	**0.0	*27.9	44	73	3
0910004S	New Braunfels 4	36	*0.0	***	*19.0	49	82	3
Tyler MSA (Region 5)								
4230003S	Tyler	50	0.0	**0.0	19.1	58	97	4
Wichita Falls MSA (Region 3)								
4850002S	Wichita Falls	107	0.0	**0.0	27.1	53	88	4

S State monitoring site (added to end of AIRS site number)

L Local governmental agency monitoring site (added to end of AIRS site number)

† Including exceptional event days

Expected number of days over 150 $\mu\text{g}/\text{m}^3$ — annual average not to exceed 1.0 day per year over a three-year period

* Each * indicates one year not meeting EPA completeness criteria; not valid for NAAQS comparison

‡ Data not available

LEAD

Lead was analyzed from particulate filters collected at 33 monitoring sites in Texas by the TNRCC and local governments during 1991, as shown in the adjacent map. In most areas of the state, lead in the ambient air is the result of automotive sources burning leaded fuels. In a few areas, lead is also released into the air by lead smelters. Since leaded gasoline is being phased out, atmospheric lead from automotive sources has been decreasing in recent years. Lead occurs in ambient air as particulate matter and thus is collected on high-volume filters with other particulate matter. The filters are subjected to atomic absorption analysis to determine lead content. The lead NAAQS is $1.5 \mu\text{g}/\text{m}^3$ for a one-quarter average, not to be exceeded.

In the past, the lead standard has been exceeded only at monitoring sites near active lead smelters. The highest lead levels in 1991 were recorded at sites that are near lead smelters in the Dallas and El Paso metropolitan areas.

Table 8 provides a summary of the 1991 lead measurements at each monitoring site. The table listings are grouped by metropolitan area and sorted in descending order from the highest quarterly average.

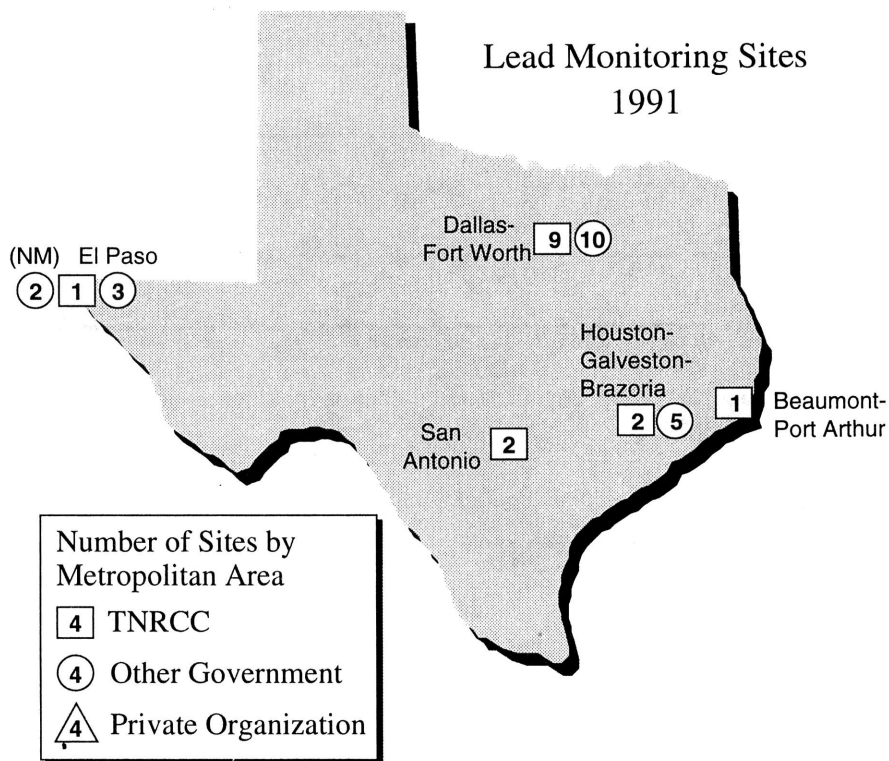


Table 8. Lead Summary 1991

AIRS	Site Name	Qtr High ($\mu\text{g}/\text{m}^3$)	Qtr Exc (#)	Samples	Valid Qtrs
NAAQS		1.5			
Beaumont-Port Arthur MSA (Region 10)					
2450009S	Beaumont 2	0.03	0	59	4
Dallas-Fort Worth CMSA (Region 4)					
0850002S	Frisco Gould Δ	1.11	0	59	4
0850003S	Frisco 5th St Δ	0.67	0	58	4
1130018L	Morrell	0.19	0	59	4
1130066L	Nolen Δ	0.18	0	274	4
1130065L	Rector Δ	0.17	0	273	4
1130064L	Sargent Δ	0.14	0	270	4
0850001S	Frisco Acker Δ	0.11	0	59	4
1130057L	Boys Club Δ	0.11	0	54	4
1130074S	Garland Valspar Δ	0.10	0	15	1
1130061L	Earhart	0.08	0	41	3
1130073S	Palmer Paper Δ	0.06	0	13	1
1130046L	M L King	0.05	0	58	4
1130050L	Convention	0.04	0	57	4
1130071S	Farmers Branch	0.03	0	31	2
1130029L	Douglas	0.03	0	60	4
1130047L	Sunnyvale	0.02	0	43	2
1130045S	Dallas N 5	0.02	0	58	4
4391003S	Ft Worth Dtn 16	0.02	0	50	3
4390023S	Worth Heights	0.02	0	59	4
El Paso-Juarez Area TX NM MX (Region 6)					
1410002L	Tillman	0.46	0	58	4
1410033L	Kern	0.25	0	57	4
1410027S	Downtown 6	0.23	0	49	4
0130004S	Race Track NM	0.16	0	60	4
1410010L	Northeast	0.15	0	59	4
0130017S	Sunland NM	0.13	0	60	4
Houston-Galveston-Brazoria CMSA (Region 12)					
2010054L	Kress	0.03	0	52	3
1671002S	Texas City 2	0.02	0	42	1
2011034S	Houston East	0.02	0	55	4
2011035L	Clinton	0.02	0	51	3
2010048L	Fulton	0.01	0	57	4
2010045L	Bingle	0.00	0	59	4
2011037L	Crawford	*	*	8	0
San Antonio MSA (Region 13)					
0290034S	ITC	0.03	0	56	4
0290050S	Airport	0.02	0	57	4

S State monitoring site (added to end of AIRS site number)

L Local governmental agency monitoring site (added to end of AIRS site number)

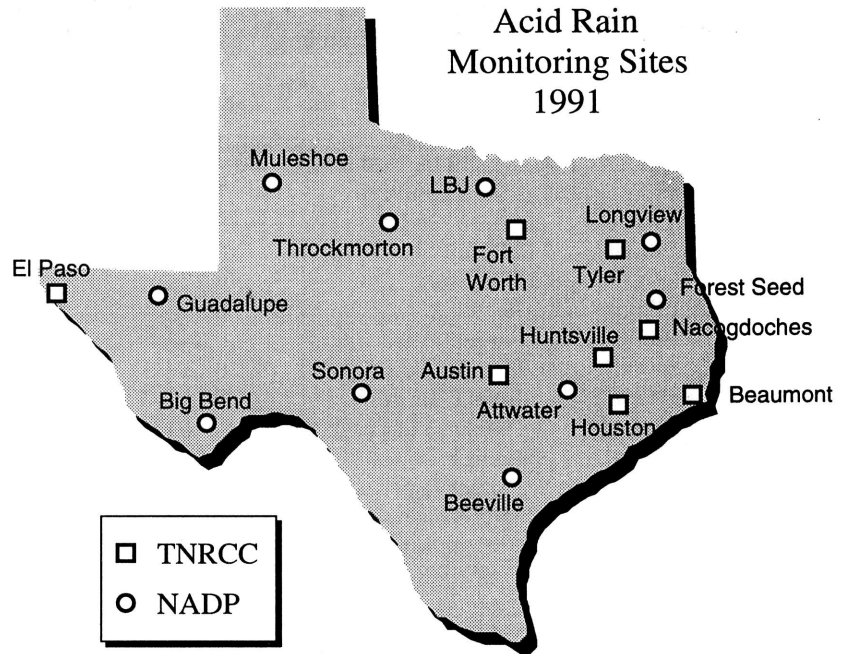
Δ Site near lead smelter

Number of quarters exceeding the NAAQS

* Insufficient data return

ACID RAIN

Acid rain was monitored by the TNRCC or federal government at 18 sites in Texas during 1991. The TNRCC participated in the National Atmospheric Deposition Program (NADP) and National Trends Network (NTN) with an automated sampler in Longview that captured rainfall over one-week periods. These samples are forwarded to the NADP for analysis and the results are published annually. The TNRCC also conducted seven-day rainfall sampling at Huntsville and event monitoring at seven additional locations shown in the adjacent map. Event samples were collected during individual rainstorms, and pH and conductivity of the samples were measured immediately in the field. The samples were then forwarded to Austin where pH and conductivity measurements were repeated.



The samples were then forwarded to Austin where pH and conductivity measurements were repeated.

The pH scale is a logarithmic measure of acidity or alkalinity. A pH of seven is neutral, with higher numbers corresponding to increased alkalinity and lower numbers to increased acidity. Unpolluted rainwater has a slightly acidic pH of 5.6. This acidity is caused by the formation of carbonic acid from CO in the atmosphere.

Table 9 provides a summary of acid rain measurements during 1991.

Table 9. Acid Rain Summary 1991

Site	Average pH	Maximum pH	Minimum pH	Samples
Longview*	4.51	6.11	3.88	46
Austin	4.75	5.06	4.50	3
Forest Seed*	4.77	7.23	4.08	46
Huntsville	4.83	5.55	4.32	23
Tyler	4.86	5.21	4.23	6
Houston	4.88	6.03	4.19	26
Attwater*	4.89	6.36	4.20	40
Throckmorton*	5.04	7.25	4.12	31
L.B.J.*	5.05	6.67	4.44	38
Beaumont	5.08	6.22	4.19	22
Beeville*	5.08	7.24	4.31	34
Fort Worth	5.13	5.32	4.93	2
Muleshoe*	5.24	6.81	4.18	32
Sonora*	5.25	7.02	4.47	37
Big Bend*	5.39	6.75	4.58	33
Guadalupe*	5.39	6.98	4.67	29
Nacogdoches	5.50	6.22	5.09	8
El Paso				0

* NADP/NTN site

Note: Acidity (pH) of unpolluted rainwater is 5.6. Lower values are more acidic and higher values are less acidic.

ABBREVIATIONS

Pollutants

CO	Carbon monoxide
NO ₂	Nitrogen dioxide
O ₃	Ozone
PM ₁₀	Particulate matter of ten microns or less
SO ₂	Sulfur dioxide

Measurement Units

ppm	parts per million (volume ratio)
µg/m ³	micrograms (10 ⁻⁶ grams) per cubic meter

Metropolitan Areas

Amr	Amarillo
Aus	Austin
BPA	Beaumont–Port Arthur
BrH	Brownsville–Harlingen
Crp	Corpus Christi
DFW	Dallas–Fort Worth
EPJ	El Paso–Juarez
HGB	Houston–Galveston–Brazoria
KiT	Killeen–Temple
Lrd	Laredo
Lub	Lubbock
Lvw	Longview
MX	Mexico
NM	New Mexico
OdsM	Odessa–Midland
SAt	San Antonio
TX	Texas
Tyr	Tyler
Vct	Victoria
WFl	Wichita Falls

Other

2nd Day	Second highest daily maximum one-hour average
Ann	Annual
AIRS	Aerometric Information Retrieval System
CMSA	Consolidated Metropolitan Statistical Area
Comp	Completeness (of data on annual basis for NAAQS comparisons)
days/yr	days per year
EPA	U. S. Environmental Protection Agency
Exc	Exceedances (number of times NAAQS was exceeded)
Exp Exc	Expected Exceedances (for O ₃ and PM ₁₀ using EPA methods)
Hi–Vol	High–Volume Sampler (used for lead measurements)
Hr	Hour
HRM	Houston Regional Monitoring
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NTN	National Trends Network
PMSA	Primary Metropolitan Statistical Area
Qtr(s)	Quarter (calendar)
SETRPC	Southeast Texas Regional Planning Commission
TNRCC	Texas Natural Resource Conservation Commission

