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**The South East Texas Regional
Planning Commission
Summer 1991 Special Ozone Study**

March 1992

Presented to:

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Prepared by: -

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26 March 1992

completeness criteria prescribed by EPA for such programs and documented in 40 CFR 58, Appendix B.

Speciated volatile organic measurement data derived from the canister sampling was reviewed for reasonableness and to ensure that the analytical systems met operating criteria prior to analysis. The analytical results were for the most part, on a concentration per species basis, similar to what has been recorded throughout the ongoing SETRPC program. However, certain samples collected on 4 of the 12 canister sample collection days had unusually high total-non-methane hydrocarbon (TNMHC) levels.

Further review of the analytical data for these samples indicated that the high TNMHC concentrations resulted mostly from high levels of ethanol and other commonly used solvents. Sampling and analytical quality control data did not indicate problems either in the sample collection/handling or the analytical process and suggest that these elevated solvent concentrations were "real". On the other hand, these solvent concentrations were noted as inconsistent with data previously collected in the study area and therefore deserve a note of caution when used in additional analysis or reporting of this data.

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The Southeast Texas Regional Planning Commission (SETRPC) serves as a coordinating agency for an industrial cooperative ambient air monitoring program in the Beaumont/Orange/Port Arthur area of southeast Texas. This area has been classified as a "serious" ozone non-attainment area by the Clean Air Act (CAA) revisions of 1990. The U.S. Environmental Protection Agency (EPA) and Texas' Air Control Board (TACB) are mandated by the CAA to revise the state implementation plan (SIP) to demonstrate how the area will be brought into attainment with the National Ambient Air Quality Standard (NAAQS) for ozone in the timeframe required by the CAA. Local industry funds the on-going ambient air monitoring program to ensure sufficient and accurate air quality information are available to support EPA and TACB in the SIP process. Participants in the program are listed in Table 1-1.

During the summer of 1991, the SETRPC monitoring group sponsored a special summer ozone study. The study was supplementary to the existing monitoring and included aloft sampling of volatile organic carbon (VOC) species, special 6-9 A.M. ground-level VOC sampling on days the aircraft was operated, and the addition of a new ozone and nitrogen oxides continuous monitoring station. The monitoring network configuration for the special study, including parameters sampled, is provided in Table 1-2. Geographical distribution of the monitoring locations is provided in Figure 1-1.

The special summer ozone study extended from early August through September 1991. The new "Fannett" monitoring station was commissioned on 10 August 1991 and operated through the end of September 1991. During this period, an aircraft was operated on select days to collect whole air canister samples aloft. The SETRPC summer study project manager (Mr. Chris Rabideaux/Texaco) used an ozone forecasting schema to select days for aircraft sampling. Specific details of the aircraft sampling are available through the Mr. Rabideaux. Aircraft and 6-9 A.M. ground station canister sampling dates and the number of samples collected are provided in Table 1-3.

Table 1-1
SETRPC Monitoring Program Participants

American Petrofina Oil and Chemical Company
E.I. DuPont de Nemours & Company
Goodyear Tire & Rubber Company
Chevron USA
South Hampton Refining Company
Ameripol Synpol Company
Star Enterprise
Texaco Chemical Company
UNOCAL 76
Mobil Oil Corporation
Mobil Chemical Company/Olefins
Mobil Chemical Company/BCSP
Gulf States Utilities
Temple-Inland
Mobil Chemical Company/LDPE
E.I. DuPont de Nemours & Company
Chevron Chemical Company
Firestone Synthetic Rubber & Latex Company
Inland Orange, Inc.
Polysar Gulf Coast, Inc.
Rescar, Inc.
Chevron Pipe Line Company
U.S.I. Division
Allied Signal, Inc.
P. D. Glycol
Southeast Texas Regional Planning Commission
Texas Air Control Board

Table 1-2
SETRPC Summer Ozone Study Measurements

Air Quality & Meteorological Parameters (Hourly Measurements)	Sabine Pass (40)	West Orange (41)	Mauriceville (42)	Jefferson County Airport (43)	Fannett (46)	Aircraft
Ozone (O ₃)	X	X	X	X	X	
Nitrogen Dioxide (NO ₂)	X	X	X	X	X	
Nitrogen Oxide (NO)	X	X	X	X	X	
Nitrogen Oxides (NO _x)	X	X	X	X	X	
Total - Non-methane Hydrocarbon (NMHC)	X	X	X	X		
Wind Speed Average (WSA)	X	X	X	X	X	
Wind Speed Resultant (WSR)	X	X	X	X	X	
Wind Direction Average (WDA)	X	X	X	X	X	
Wind Direction Resultant (WDR)	X	X	X	X	X	
Ambient Temperature (TOUT)	X	X	X	X	X	
Wind Standard Deviation (Sigma θ)	X	X	X	X	X	
VOC Canister Sampling (see Species List)	X	X	X	X	X	X
Speciated Volatile Organic Compounds						
p-m-Xylene	2,2,4-Trimethyl pentane	Butadiene				
o-Xylene	t-Butylbenzene	Chloroform				
1,2-Dichloroethane	a-Pinene	Cyclohexane				
n-Hexane	b-Pinene	Ethylene				
n-Octane	Acetaldehyde	Methanol				
Methylcyclohexane	n-Decane	Propylene				
Isohexane	Chlorobenzene	Styrene				
3-Methylpentane	Vinyl Chloride	1,2,4 Trimethylbenzene				
1-Butene + Isobutene	Dichloromethane (Methylene Chloride)	Toluene				
Propane	Methyl t-butyl ether	Ethyl Benzene				
n-Pentane	n-Butyl alcohol (1 butanol)	Butyl Acrylate				
Isopentane	Butyraldehyde (2-butanone)	Methyl Acrylate				
Carbon Tetrachloride	n-Pentene (1-pentene)	Trichloroethylene				
Hexanal	1-Hexene	Vinyl Acetate				
1,1,1-Trichloroethane	1-Octene	Methyl Ethyl Ketone (2 butanone)				
n-butane	Acetone	Napthalene				
Trichlorofluoromethane	Acetonitrile	Cumene				
Ethane	Benzene	Isoprene				

Note 1: Site 40, 41, 42, 43, 46 canister samples collected between 6-9 a.m. on select days, see list in Table 1-3.

Note 2: Specific sampling times for aircraft canister samples available from SETRPC project manager.

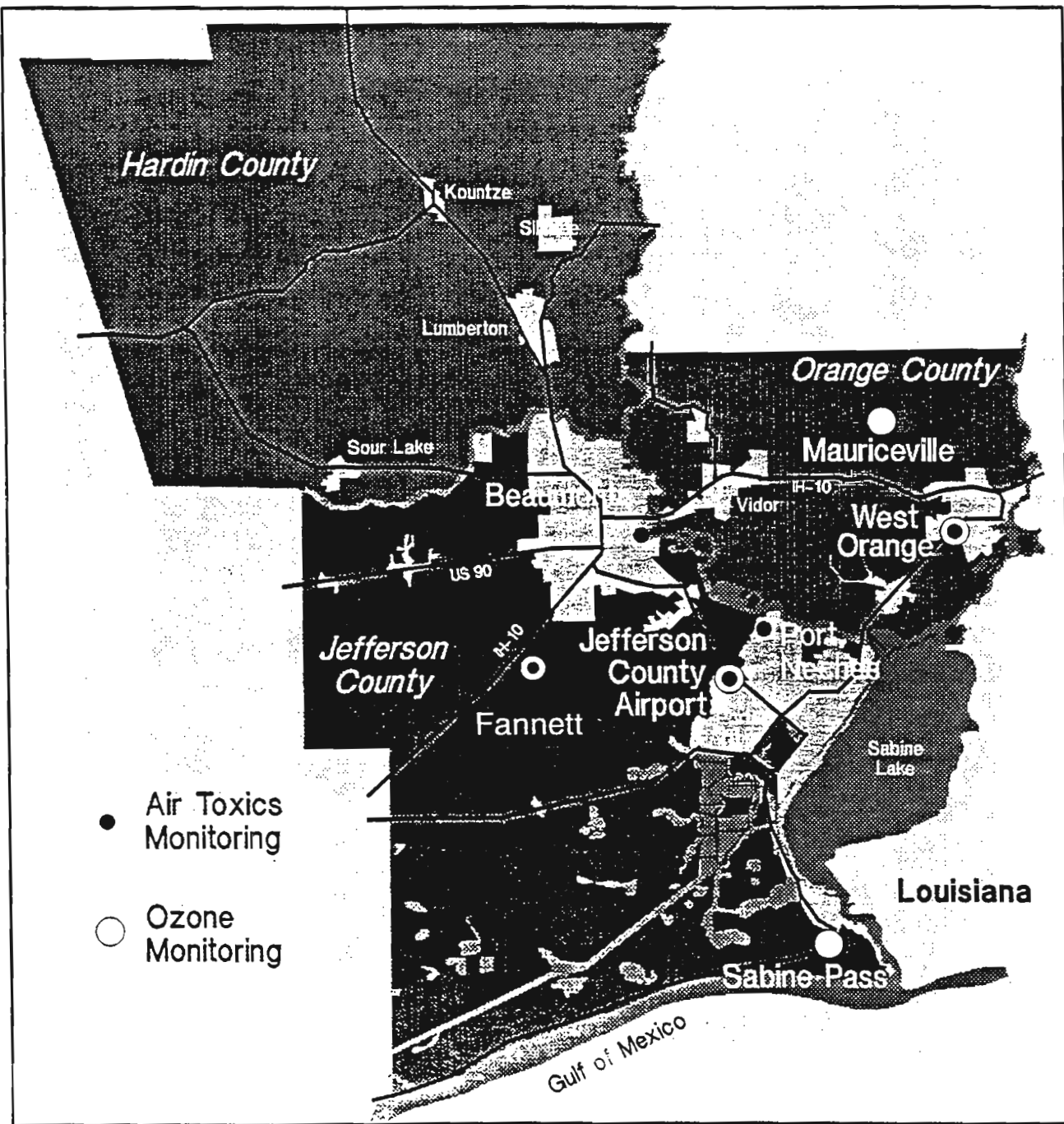


Figure 1-1. SETRPC Monitoring Site Locations

Table 1-3
Aircraft and Ground-Based Canister Sampling
Schedule for the SETRPC Summer Ozone Study

Sample Date	Sabine Site 40	West Orange Site 41	Mauriceville Site 42	Airport Site 43	Fannett Site 46	Aircraft
8/19/91	1	0	1	1	1	3
8/20/91	1	1	1	1	1	4
8/21/91	1	1	1	1	1	3
8/24/91	1	1	1	1	1	3
8/25/91	1	1	1	1	1	2
8/30/91	1	1	1	1	1	2
9/10/91	1	1	1	1	1	2
9/12/91	1	1	1	0	1	2
9/13/91	1	1	0	1	1	2
9/26/91	1	1	1	1	1	0
9/27/91	0	1	1	1	1	0
9/28/91	1	1	1	1	1	0
Totals	11	11	11	11	12	23

NOTE: Site 40, 41, 42, 43, and 46 samples collected 6-9 a.m.

Data collected from the Fannett monitoring site, the aircraft canister sampling, and the 6-9 A.M. ground-based canister sampling are presented in this report. All other data collected from the on-going SETRPC monitoring network, coincident with the special study, are reported in the standard monthly SETRPC reports for August and September 1991.

2.0

SPECIAL SUMMER OZONE STUDY MONITORING RESULTS

During the special ozone study conducted in August and September of 1991, criteria pollutants and meteorological parameters were measured continuously at five (5) sites. Four of these sites were previously established SETRPC sites, located at Sabine Pass, West Orange, Mauriceville, and Jefferson County Airport. The fifth site, Fannett, was established in August 1991 especially for the ozone study. All parameters measured at the previously established SETRPC sites were also measured at Fannett, except continuous total non-methane hydrocarbon concentrations (TNMHC). Criteria pollutant and meteorological data collected at the Fannett site are presented in Appendix A.

Table 2-1 presents criteria pollutant, VOC and meteorological data collected at ground-level SETRPC sites during the twelve (12) episodes selected for the special study. The table includes the highest and second highest ozone concentrations recorded at each site during the day, and the first hour that those concentrations were recorded. Two different measurements of TNMHC are presented: mean concentrations recorded by continuous NMHC analyzers from 6-9 A.M. on the day of the predicted episode, and an integrated 3-hour canister sample collected from 6-9 A.M. on the episode day. Both measures are presented as ppb-C. Mean concentrations of nitrogen oxides (NO_x) recorded from 6 AM - 9 AM are also presented. Corresponding average wind speed and wind direction data for each hour between 6-9 A.M. are presented for each site.

Speciated VOC data were collected by canister sampling during the twelve selected episodes at five (5) different ground-level sites: Site 40-Sabine Pass, Site 41-West Orange, Site 42-Mauriceville, Site 43-Jefferson County Airport, and Site 46-Fannett. Summary VOC data for each selected episode are presented in Tables 2-2 (a-l). The following statistics are presented for the target compounds:

- reporting limits (ppbv-species),
- maximum and minimum recorded concentrations (ppbv-species),
- mean concentrations (ppbv-species), and
- percentage of sites within the network that recorded concentrations greater than the reporting limit.

Tables 2-3 (a-l) present VOC data collected at all sites during each episode date.

In addition to the ground-level samples, upper air canister samples were collected by aircraft on nine of the selected episode days. Table 2-4 presents target compound concentrations for each day that sampling aloft occurred. The individual samples collected on the episode date are identified by sample number.

In a few cases, canister TNMHC concentrations were much higher than continuous TNMHC concentrations. In each of these cases, >70% of the TNMHC concentration was due to non-target compounds, especially methanol, ethanol and acetone. All laboratory and sampling procedures and quality control data were reviewed for each of these cases. There was no indication that the high concentrations of these compounds resulted from contamination of the samples or from artifacts in the canisters residual from previous sampling events. While the TNMHC concentrations were significantly higher than historically reported from this area, there is no confirmable data or compelling evidence to suggest that these higher concentrations are not "real". However, caution should be applied when applying this data in subsequent analysis and reporting of this information.

Both Radian and the Texas Air Control Board (TACB) conducted audits of the continuous measurement systems at the SETRPC sites during the special ozone study in August and September 1991. The Radian audit resulted in no Recommendations for Corrective Action, but two informal recommendations were made: (1) investigate the extent of the -1.8°F error noted during the 16 October audit, and

correct the Airport ambient temperature data base accordingly, and (2) correct the Fannett wind direction data base by adding 3° to all data from the project start-up until the audit on 19 August 1991 at 16:55. Both of these informal recommendations were carried out.

TACB conducted an audit of ozone and nitrogen oxide monitors at five SETRPC sites during the week of 23 September 1991. Monitors at the Jefferson County Airport, Sabine Pass, West Orange and Mauriceville, which had been audited several times before by TACB, were audited at only a single gas concentration, whereas the Fannett monitors were audited at three different concentrations, since they were being audited for the first time. No recommendations for corrective action were issued regarding any monitor at any site. The full text of the Radian quality assurance audits and the TACB audit are included in the Appendices.

Table 2-1
Special Ozone Study Monitoring Results
Episode 1, 19 August 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	80 22:00 hr.	77 23:00 hr.	101	6300	15.3	06:00 07:00 08:00	3.8 6.8 5.7	308 314 330
Site 41 - West Orange	57 16:00 hr.	56 17:00 hr.	50	--- ^a	12.7	06:00 07:00 08:00	3.1 4.5 3.8	277 272 302
Site 42 - Mauriceville	51 13:00 hr.	49 12:00 hr.	--- ^a	208	--- ^a	06:00 07:00 08:00	--- ^a --- ^a --- ^a	--- ^a --- ^a --- ^a
Site 43 - Airport	55 15:00 hr.	53 13:00 hr.	74	284	15.3	06:00 07:00 08:00	2.5 7.4 4.2	340 4 329
Site 46 - Fannett	62 14:00 hr.	61 16:00 hr.	--- ^b	260	29.3	06:00 07:00 08:00	2.8 2.0 1.7	266 55 55

^a Not available because data invalid or missing.

^b Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 2, 20 August 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	67 00:00 hr.	63 18:00 hr.	610	849	8.3	06:00 07:00 08:00	3.2 3.5 3.0	36 37 52
Site 41 - West Orange	70 13:00 hr.	69 14:00 hr.	662	6560	37.3	06:00 07:00 08:00	1.1 0.8 2.0	41 33 50
Site 42 - Mauriceville	79 16:00 hr.	78 12:00 hr.	250	7150	32.0	06:00 07:00 08:00	0.3 0.2 0.5	23 47 51
Site 43 - Airport	70 10:00 hr.	66 16:00 hr.	163	9520	50.0	06:00 07:00 08:00	2.1 1.8 2.1	18 17 37
Site 46 - Fannett	101 12:00 hr.	94 15:00 hr.	--- ^a	4930	76.0	06:00 07:00 08:00	1.2 2.3 1.4	274 326 51

^a Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 3, 21 August 1991

Site Location	Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	94 09:00 hr.	91 08:00 hr.	560	429	9.0	06:00 07:00 08:00	1.8 1.7 2.7	275 286 306
Site 41 - West Orange	103 12:00 hr.	101 11:00 hr.	740	982	66.0	06:00 07:00 08:00	0.7 0.4 0.8	69 45 320
Site 42 - Mauriceville	113 15:00 hr.	98 14:00 hr.	--- ^a	157	--- ^a	06:00 07:00 08:00	--- ^a --- ^a --- ^a	--- ^a --- ^a --- ^a
Site 43 - Airport	73 13:00 hr.	72 10:00 hr.	890	1100	24.7	06:00 07:00 08:00	1.3 1.4 2.0	208 254 287
Site 46 - Fannett	75 11:00 hr.	72 12:00 hr.	--- ^b	1600	45.7	06:00 07:00 08:00	1.1 0.3 0.5	192 137 268

^a Not available, data invalid or missing.

^b Continuous TNMHC not collected at Fannett.

Table 2-1

**Special Ozone Study Monitoring Results
Episode 4, 24 August 1991**

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	86 14:00 hr.	84 11:00 hr.	690	638	5.0	06:00 07:00 08:00	3.0 3.9 4.3	17 352 24
Site 41 - West Orange	88 11:00 hr.	85 13:00 hr.	300	585	25.3	06:00 07:00 08:00	1.3 1.5 2.4	343 16 359
Site 42 - Mauriceville	79 12:00 hr.	76 11:00 hr.	720	262	14.3	06:00 07:00 08:00	0.5 0.4 0.5	10 33 9
Site 43 - Airport	89 11:00 hr.	84 13:00 hr.	1960	1230	34.3	06:00 07:00 08:00	1.7 2.3 3.5	342 332 357
Site 46 - Fannett	110 12:00 hr.	103 13:00 hr.	--- ^a	820	35.3	06:00 07:00 08:00	2.6 3.0 3.2	319 333 349

^a Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 5, 25 August 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	86 12:00 hr.	85 17:00 hr.	860	617	16.3	06:00 07:00 08:00	3.1 2.8 3.4	331 349 7
Site 41 - West Orange	72 15:00 hr.	70 16:00 hr.	290	484	9.0	06:00 07:00 08:00	1.5 2.6 2.9	320 312 8
Site 42 - Mauriceville	70 15:00 hr.	64 16:00 hr.	400	559	7.3	06:00 07:00 08:00	0.4 0.5 2.2	259 298 7
Site 43 - Airport	69 16:00 hr.	67 15:00 hr.	840	549	15.7	06:00 07:00 08:00	2.7 2.8 3.3	336 346 345
Site 46 - Fannett	75 11:00 hr.	72 12:00 hr.	--- ^a	508	16.3	06:00 07:00 08:00	3.0 2.9 3.3	326 329 5

^a Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 6, 30 August 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	44 15:00 hr.	40 16:00 hr.	320	844	9.7	06:00 07:00 08:00	3.9 3.0 3.0	296 312 326
Site 41 - West Orange	67 13:00 hr.	44 14:00 hr.	370	767	63.3	06:00 07:00 08:00	0.3 0.7 1.6	89 332 321
Site 42 - Mauriceville	35 13:00 hr.	31 15:00 hr.	370	840	42.7	06:00 07:00 08:00	0.4 0.4 0.4	84 38 246
Site 43 - Airport	83 13:00 hr.	79 16:00 hr.	680	1430	28.3	06:00 07:00 08:00	1.2 0.6 3.4	274 281 305
Site 46 - Fannett	54 12:00 hr.	40 15:00 hr.	--- ^a	2030	59.3	06:00 07:00 08:00	1.1 0.8 1.6	247 338 298

^a Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 7, 10 September 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous 6-9 am Mean	Canister 6-9 am Mean				
Site 40 - Sabine Pass	54 15:00 hr.	52 14:00 hr.	280	430	5.3	06:00 07:00 08:00	6.1 6.7 8.5	58 62 70
Site 41 - West Orange	51 16:00 hr.	50 15:00 hr.	190	1040	15.3	06:00 07:00 08:00	4.3 6.0 5.9	66 79 83
Site 42 - Mauriceville	53 17:00 hr.	52 16:00 hr.	360	135	19.3	06:00 07:00 08:00	1.6 1.9 3.0	54 72 79
Site 43 - Airport	54 15:00 hr.	51 14:00 hr.	570	1010	22.7	06:00 07:00 08:00	2.5 3.4 4.0	57 68 74
Site 46 - Fannett	55 12:00 hr.	52 16:00 hr.	--- ^a	366	25.7	06:00 07:00 08:00	4.2 3.0 6.3	48 58 68

^a Continuous TNMHC not collected at Fannett.

Table 2-1
Special Ozone Study Monitoring Results
Episode 8, 12 September 1991

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous 6-9 am Mean	Canister 6-9 am Mean				
Site 40 - Sabine Pass	31 00:00 hr.	28 01:00 hr.	100	336	4.3	06:00 07:00 08:00	1.1 1.4 2.1	130 164 159
Site 41 - West Orange	27 11:00 hr.	26 15:00 hr.	160	468	23.7	06:00 07:00 08:00	1.1 1.5 2.9	61 20 60
Site 42 - Mauriceville	39 15:00 hr.	36 13:00 hr.	--- ^a	961	27.3	06:00 07:00 08:00	0.4 1.1 2.1	336 43 61
Site 43 - Airport	45 12:00 hr.	36 13:00 hr.	50	---	39.0	06:00 07:00 08:00	0.5 1.2 1.3	6 348 360
Site 46 - Fannett	28 12:00 hr.	27 11:00 hr.	--- ^b	1660	47.3	06:00 07:00 08:00	1.6 1.8 2.4	326 355 40

^a Not available, data invalid or missing.

^b Continuous TNMHC not collected at Fannett.

Table 2-1

**Special Ozone Study Monitoring Results
Episode 9, 13 September 1991**

Site Location	Maximum Ozone (ppb)		6-9 AM Mean TNMHC Concentration (ppbC)		6-9 AM Mean NO _x Concentration (ppb)	Hour	Wind Speed (mph)	Wind Direction (deg)
	High	2nd High	Continuous	Canister				
Site 40 - Sabine Pass	41 20:00 hr.	40 23:00 hr.	--- ^a	502	9.7	06:00 07:00 08:00	1.1 2.3 2.9	119 294 29
Site 41 - West Orange	47 17:00 hr.	44 16:00 hr.	200	6490	24.3	06:00 07:00 08:00	1.3 1.9 4.4	43 51 61
Site 42 - Mauriceville	51 14:00 hr.	47 15:00 hr.	360	--- ^a	23.0	06:00 07:00 08:00	0.4 0.4 2.3	41 43 72
Site 43 - Airport	48 13:00 hr.	43 17:00 hr.	720	769	43.0	06:00 07:00 08:00	1.3 1.4 3.0	9 15 20
Site 46 - Fannett	36 12:00 hr.	31 14:00 hr.	--- ^b	362	50.7	06:00 07:00 08:00	0.8 0.9 2.1	44 359 59

^a Not available, data invalid or missing.

^b Continuous TNMHC not collected at Fannett.