MONITORING OZONE AT MOUNT EQUINOX AND LYE BROOK WILDERNESS, GREEN MOUNTAIN NATIONAL FOREST, SOUTHERN VERMONT - 1994 REPORT

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ABSTRACT

From 30 May to September 1994, ambient ozone was continuously monitored with an active sampler (Thermo Electron Model 49 UV-photometric ozone monitor at the Mt. Equinox Site (549 m) for the sixth consecutive year. Ozone concentrations between late May and early September reached or exceeded 80 parts per billion (ppb (Green Line Screening Value) for a total of hours 37 hours in 1993), and 50 ppb (probable threshold for plants for a total of 493 hours (446 hours in 1993). Ozone concentrations for a single day were highest in June with peak concentrations reaching 86.0 ppb 13 June , and again on 4 August, when ambient ozone reached a mean hourly concentration of 81.3 ppb. In addition to the ozone monitor at the Mt. Equinox site, ozone was monitored in the Lye Brook Wilderness Area at Prospect Rock (634 m), and at an EPA Environmental Monitoring Site 729 m) at nearby Kelly Stand Both of these locations, as well as the Mt. Equinox site, were monitored for a six-week period between 5 July and 16 August 1994 using passive filter-type ozone samplers (Ogawa & Co. for one-week exposure periods. Compared to results from 1993, agreement of mean 7-day ozone concentrations between passive samplers and the active ozone monitor was very good.

INTRODUCTION

In 1964 the U.S Congress established the National Wilderness Preservation system, setting aside wilderness areas in the United States As a result of the 1977 amendments to the Clean Air Act, the largest wilderness areas, established prior to 1977, were designated as Class I areas. The intent of these amendments was to prevent significant deterioration of air quality in these areas (1 ederal land managers of Class I areas are thus required to assess air quality and the effects of air pollution on a wilderness area. Their findings are used to make decisions about new pollution-emitting facilities near Class areas.

Tropospheric ozone has become the most pervasive phytotoxic air pollutant in wilderness areas in the northeastern United States (2,3). Most of he surface level ozone occurring in New England enters the region from metropolitan New York and southward via long-range transport (4,5). Ozone concentrations are normally higher in rural and forested areas, and at higher elevations, particularly in connection with episodes of high temperatures (5,6,7,8).

A number of native plant species respond to ambient ozone by producing typical symptoms of foliar injury, usually a pigmented stipple, with or without chlorosis (9,10, ,12,13,14). This makes it possible to use certain ozone-sensitive plants as bioindicators of ambient ozone (3,12,14,15,16).

In June of 1989, we began to monitor ambient ozone in an open field on a slope of Mt. Equinox, near the Lye Brook Wilderness Area in the Green Mountain National Forest in southern Vermont. Open-top chambers were also used to screen plants for ozone sensitivity and to assess the effects of ozone

on selected trees, woody shrubs, and herbaceous plants. Reports of these results for the years 1989-1993 are on file and should be consulted for further detail. Vegetation survey reports from 1988-1993 by J. O'Brien (USFS Durham, NH) are also available.

Our objectives in 1994 were similar to previous years and included (i) continued monitoring of ambient ozone at Mt. Equinox with an ozone monitor and (ii) evaluation of a new passive ozone sampler in relation to the active ozone monitor.

METHODS

Ozone monitor

As in previous years, ambient ozone was continuously monitored with a Thermo Electron 49 ozone monitor, located in an air-conditioned building maintained at 20-28 °C (EPA range 20-30 °C in an open field (549 m) on a slope of Mt. Equinox. The site lies approximately 1 km west of the Lye Brook Wilderness Area across the valley of the Batten Kill River in southwestern Vermont. The University of Massachusetts laboratory standard ozone monitor (Dasibi 1008 UV-photometric ozone analyzer), calibrated by the Massachusetts Department of Environmental Protection, was used for calibration of the transfer standard ozone monitor, also a Dasibi 1008 monitor, and the on-site monitor. The transfer standard ozone monitor was in turn used for all subsequent audits of the on-site monitor. Full audits were conducted when the on-site monitor was installed and weekly thereafter for a period of four weeks. Partial audits were then performed twice monthly for the remainder of the summer until 1 September, when a full exiting audit was done and the site shut down for the monitoring season.

Passive samplers

Passive ozone samplers are a relatively new monitoring technology. They represent a simple, inexpensive method of cumulative ozone monitoring suitable for remote Wilderness Areas.

During the six-week period between July 5-August 16, 1994, a total of thirty plastic, cylindrical Ogawa passive ozone samplers were exposed to ambient ozone using five samplers at each weekly interval. All samplers were housed in waterproof plastic rain shelters to prevent moisture from contaminating their filters and hung three meters above ground, the height at which the active monitor samples ambient ozone. Each week, one sampler was co-located with the active ozone monitor at the Mt. Equinox Site, one sampler was placed at an exposed rock outcrop at Prospect Rock (634 m) in the Lye Brook Wilderness Area, and one sampler was located at an environmental monitoring site 729 m) centered in a circular hilltop clearing approximately four hectares in size, near Kelly Stand in the Town of Sunderland, Vermont, approximately 12.5 km southeast of the Mt. Equinox site. The filters were collected weekly and placed in airtight vials, the period of exposure in ambient conditions recorded, and replaced by new filters.

The passive samplers in this study utilized two nitrite-coated filters inside a small plastic cylinder. When exposed to ambient ozone, nitrite is oxidized to nitrate. Exposed filters were removed from the sampler housing and the filter nitrate was extracted and analyzed by ion chromatography to determine cumulative nitrate concentration for a known exposure period (P. Koutrakis, Harvard School of Public Health, personal communication). Cumulative ozone concentration for the same period can then be determined.

RESULTS

Ozone monitor

All average hourly ozone concentrations for the period 30 May to 1 September are included in the Appendix of this report. Summary data for ambient ozone concentrations that reached or exceeded 50 parts per billion (ppb) (probable threshold for sensitive plants) and 80 ppb (Green Line Screening Value) are provided in Table 1.

Table 1: Summary of ambient ozone monitoring at Mt. Equinox, Vermont, 1994
Hours at high ozone concentrations and percent of monthly total

Months	Days	Hours	≥80 ppb*	%	≥50 ppb**	%
May	1.6	39	0	0	32	82.0
June	30	720	2	0.3	224	31.1
July	31	741***	0	0	145	19.6
August	31	744	1	0.1	92	12.4
Sept.	0.7	16	0	0	0	0

* Green Line Screening Value
** probable threshold for sensitive plants
*** periodic power outages: 3 hours lost in July

Ozone concentrations reached or exceeded 80 ppb for a total of 3 hours in 1994. Peak mean hourly concentrations were 86.0 ppb on 13 June, 80.9 on 26 June, and 81.3 on 4 August. The most sustained periods of elevated ozone concentrations occurred in June. Ozone concentrations reached or exceeded 50 ppb for a total of 494 hours, with June accounting for 224 of the total. The months of June and July combined accounted for 75 percent of the total hours exceeding 50 ppb. Mean hourly ambient ozone concentrations for 1994 are compared with those from 1989-1993 in summary fashion in Table 2. Unusually hot, dry weather in 1993 makes comparisons difficult for that season (see Figure 1 in Appendix).

Table 2: Summary of ambient ozone monitoring at Mt. Equinox Site, Vermont, 1989-1994

1989

Total no. of hours and % of total

Month	≥80 ppb*	%	≥50 ppb**	%
June	5	1.5	38	11.3
July	9	1.2	143	19.2
August	0	0	83	11.2

1990

Total no. of hours and % of total

≥80 ppb	%	≥50 ppb	%
13	2.2	194	33.7
17	2.3	170	22.8
7	0.9	82	11.0

1991

Total no. of hours and % of total

Month	≥80 ppb*	%	≥50 ppb**	%
June	57	1.0	184	31.8
July	32	4.3	228	30.6
August	29	3.8	202	27.2

1992

Total no. of hours and % of total

≥80 ppb	%	≥50 ppb	%
41	5.7	257	35.9
	0	262	15.4
2	1.8	165	25.2

1993

Total no. of hours and % of total

Month	≥80 ppb*	%	≥50 ppb**	%
June	20	2.8	141	19.6
July	6	0.8	100	13.6
August	11	1.5	187	25.2

1994

Total no. of hours and % of total

≥80 ppb	%	≥50 ppb	%
2	0.3	224	31.1
0	0	145	19.6
1	0.1	92	12.4

Green Line Screening Value
probable threshold for sensitive plants

Ozone concentrations were generally low in 1989 and 1990, increasing greatly in 1991, and perhaps due to climatic conditions, cumulative elevated concentrations ≥80 ppb have decreased annually from 1992 to 994. Total hours at concentrations of 80 ppb and above were less in 1994 than in any of the previous five years of ozone monitoring in southern Vermont (Figure 2 in Appendix). However, total hours between 50 and 80 ppb were the third highest in 1994, following 1992 and 1991, respectively.

Passive samplers

Agreement between 7-day mean ozone concentrations determined from the active ozone monitor and results from the passive samplers was generally very good Active monitor to passive sampler ratios ranged only between 0.8 and 4 while the mean ratio for the six-week period was 1.1 'able 3). This represents a significant improvement over the 1993 results testing passive samplers at five sites where ratios ranged from 1.7 to 8.2 over a ten-week period, with the mean ratio equaling 4.0 (see 1993 ozone monitoring report

Table 3: Mean 7-day ozone concentrations as determined by passive ozone samplers (Ogawa Assoc.) and an active monitor (Teco 49 ozone monitor)

	Mean weekly ozone concentrations (ppb)*						
Date	O_3 monitor	sampler #1	sampler #2**	sampler #3***	Monitor/sampler ratios		
7/5-7/12	42.2	34.1	30.6	33.0	1.2	1.4	1.3
7/12-7/19	44.2	32.1	30.8	33.2	1.4	1.4	1.3
7/19-7/26	32.5	39.9	36.3	38.9	0.8	0.9	0.8
7/26-8/2	29.1	26.7	27.6	34.7	1.1	1.1	0.8
8/2-8/9	36.8	33.0	34.5	36.3	1.1	1.1	1.0
8/9-8/16	32.5	28.2	27.8	30.4	1.2	1.2	

* Ozone concentrations for the Teco 49 monitor are the average total exposure divided by the sampling period (1 week=168 hours) Teco 49 monitor and the first passive sampler co-located at Mt. Equinox,VT (549 m)

Sampler located at Prospect Rock, Lye Brook Wilderness (634 m), approximately 11 kilometers to the east of the active monitor site at Mt Equinox

Sampler located at EPA environmental monitoring site, Kelly Stand Road (729 m), approximately 12.5 kilometers to the southeast of the active monitor site at Mt. Equinox

Table 4 gives the passive sampler difference from the active monitor on a percent basis. Passive samplers varied from the active monitor in 994 between +23 and -30 percent.

Table 4: Percent difference comparison of active monitor-passive sampler mean 7-day ozone concentrations, Green Mountain National Forest and Mt. Equinox, Vermont

Sampling period	sampler 1	sampler 2	sampler 3
7/5-7/12	-19.2	-27.5	-21.8
7/12-7/19	-27.4	-30.3	-24.9
7/19-7/26	+22.8	+12.8	+19.7
7/26-8/2	-8.6	-5.5	+18.7
8/2-8/9	-10.1	-6.0	-1.1
8/9-8/16	-13.2	-14.5	-6.3

Differences between passive sampler values and the active monitor were consistent for ive of the six weeks sampled (Figure 3 in Appendix). Passive sampler ozone concentrations for weeks and 2 were about 10 ppb lower than the active monitor, week was slightly higher and weeks 4 through 6 were only slightly lower. Passive samplers at the three sites were generally in agreement for each of the six -day exposure periods with the exception of the sampler at the EPA site , which showed a slightly elevated value in the fourth week.

DISCUSSION

As in previous years, the period of highest mean hourly ozone concentrations occurred in the month of June. Ozone as a surface level photochemical pollutant in southwestern Vermont appears to show a seasonal rend whereby elevated concentrations can be expected in June, followed by higher concentrations again in August. This year saw fewer total hours exceeding the Green Line Screening Value than all other years in the period between 1989-1994. However, compared to the five previous seasons of ozone monitoring in southern Vermont, concentrations exceeding 50 ppb for sustained periods were more common than in 1989, 1990, and 1993. Foliar effects of ozone on native vegetation were not studied sytematically in 1994 as in previous

years, so conclusions can not be drawn concerning possible wide-spread effects on native plant species in the region for 1994. Ozone injury on red-fruited elderberry (*Sambucus pubens*) and prickly lettuce *Lactuca scariola*) were noted along the road leading to Prospect Rock.

Using a new passive sampler, agreement with the ozone monitor was significantly improved from results of 1992 and 1993. Results from passive samplers exposed to ambient ozone were relatively good compared to actual ozone concentrations as determined by the active monitor. If the results prove to be consistent with further testing, these devices may be of great value for environmental monitoring at increased sampling intensities and reduced cost. Simple, reliable sampling devices for ozone and other atmospheric pollutants such as sulfur dioxide and nitrogen compounds would be particularly useful for application in remote sites and difficult terrain, such as the mountainous areas of the northeastern United States. Continued evaluation of passive samplers used for monitoring ozone should be done in conjunction with the active monitoring program

PLANS FOR 1995

Depending upon available funding, the following activities are planned for 995:

) continuation of active monitoring (ozone monitor of ozone at Mt. Equinox

ii) continued evaluation of passive ozone samplers, using increased numbers and locations in the southern Green Mountain region, Vermont

iii) surveys of vegetation near the active monitor and the passive samplers will also be conducted.

ACKNOWLEDGEMENTS

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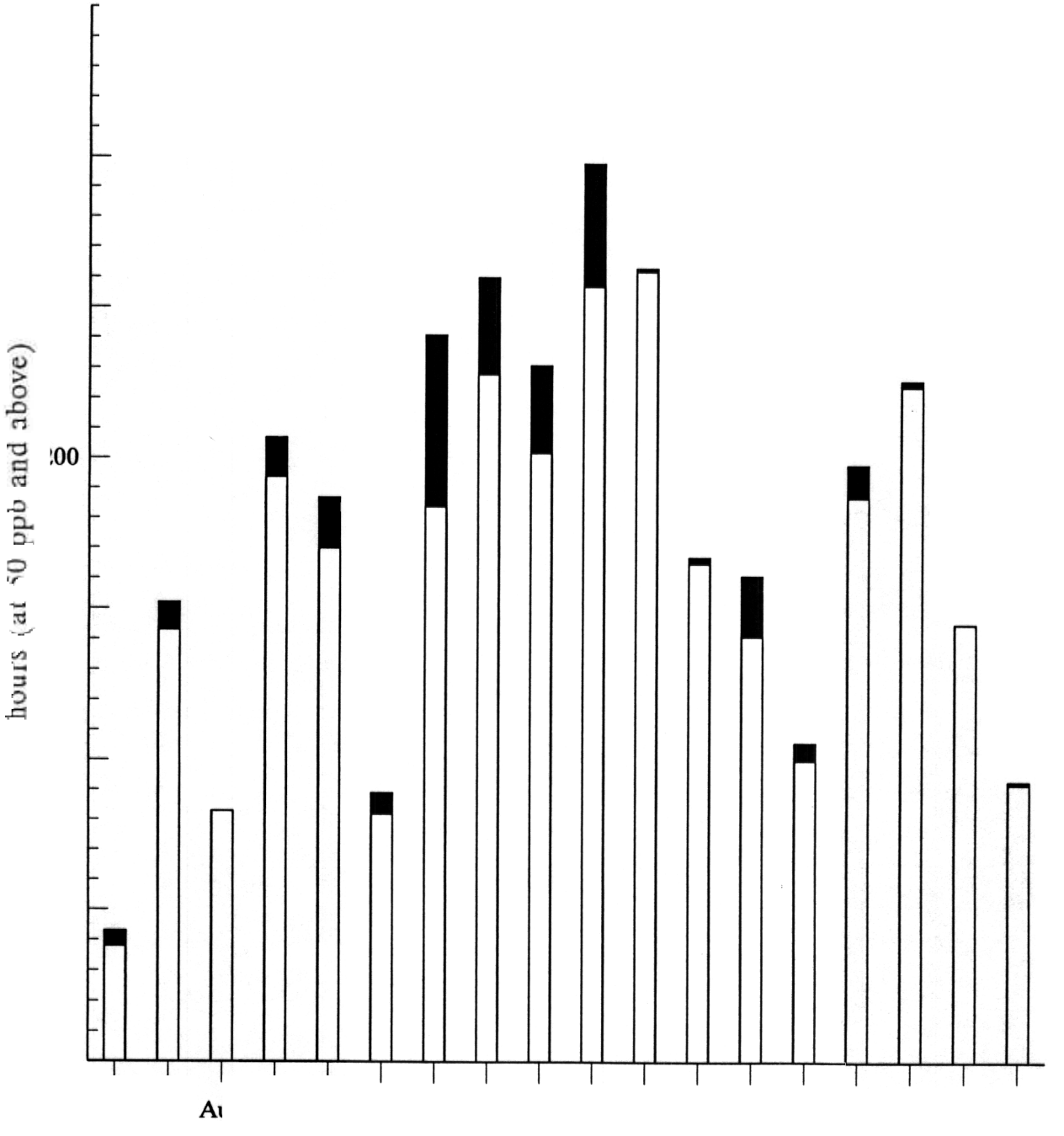
APPENDIX

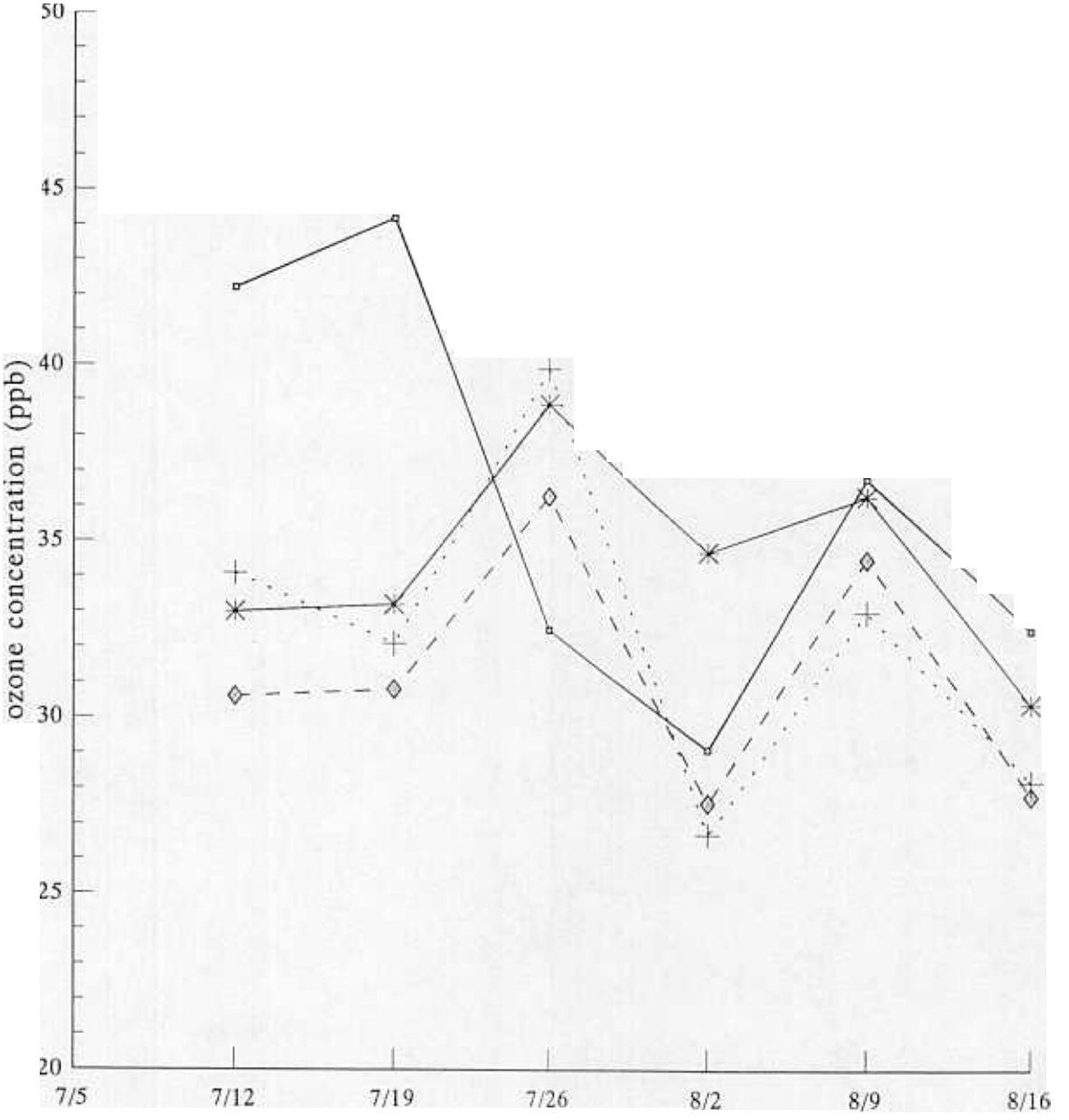
Mon h y hi h con n ra on o one ummary

M E M (4 1 4



1994 7-day mean ozone concentrations for an active monitor and passive samplers at 3 sites

Green Mountain National Forest and Mt. Equinox, Vermont



monitor and sampler #1 co-located at Mt. Washington Auto Road Site (476 m)
sampler #2 located at Lowes Bald Spot, Mt. Washington (876 m)
sampler #3 located at Mt. Crawford summit (853 m)

Figure 3

Mt. Equinox, VT Mean Hourly Ambient Ozone Levels for 1994

DATE		MAY 30	MAY 31	JUN 1	JUN 2	JUN 3	JUN 4	JUN 5	JUN 6	JUN 7	JUN 8	JUN 9	JUN 10	JUN 11	JUN 12
HOUR	0		61.8	45.2	24.3	26.8	40.5	56.0	62.0	59.3	29.5	33.2	39.8	72.4	46.8
	1		65.7	47.4	23.8	29.4	40.7	76.3	66.8	44.9	32.4	37.7	41.3	67.7	49.2
	2		66.3	49.8	22.9	32.9	40.8	79.0	61.0	41.4	32.3	40.3	43.5	74.5	47.7
	3		69.1	45.7	23.4	34.9	40.9	70.5	56.0	37.8	32.5	42.2	43.2	68.2	45.3
	4		68.3	44.1	23.0	36.3	43.2	69.6	53.2	41.0	33.4	44.8	42.9	62.5	50.4
	5		67.8	44.3	19.9	40.0	46.5	72.7	51.4	46.0	34.5	45.7	43.1	65.2	52.7
	6		67.1	40.2	17.3	42.7	47.8	69.7	57.9	48.0	35.4	44.4	43.6	65.1	50.8
	7		69.7	38.1	17.3	41.6	48.0	73.7	58.8	47.6	35.5	42.3	44.6	61.6	50.6
	8		74.1	36.8	16.9	42.0	45.0	72.6	60.7	45.1	34.0	40.1	42.6	57.6	48.9
	9	67.2	75.2	41.5	16.2	38.5	44.3	55.4	69.5	49.4	31.1	39.9	37.4	56.8	44.2
	10	67.6	75.5	45.7	15.5	35.0	36.1	63.1	65.2	54.1	31.2	38.3	39.2	61.4	48.2
	11	68.8	74.8	41.3	17.8	30.4	32.5	50.8	57.9	54.1	32.2	35.1	38.6	59.2	44.4
	12	62.4	72.7	35.9	16.3	31.6	31.0	46.7	54.4	49.8	32.4	38.1	37.1	58.8	39.3
	13	65.0	68.8	31.9	19.5	31.8	31.6	52.2	53.9	49.7	31.0	38.4	35.9	67.5	39.5
	14	67.2	64.5	32.0	18.7	33.3	33.6	59.9	55.2	56.6	30.2	37.9	38.4	65.3	41.0
	15	62.7	57.3	30.1	17.5	32.8	29.9	51.0	55.5	54.9	30.1	36.5	35.0	53.1	37.2
	16	62.9	50.6	28.3	15.3	35.2	29.7	53.7	54.3	54.4	27.8	34.0	33.5	48.3	42.5
	17	62.3	48.5	26.3	12.9	34.6	31.5	49.7	55.2	44.9	24.7	31.4	34.0	44.2	34.6
	18	58.6	45.8	26.9	12.1	32.5	30.1	49.2	53.4	19.3	24.1	27.7	37.7	42.2	37.9
	19	55.6	44.3	26.4	10.8	32.3	27.2	54.4	53.8	19.9	23.2	29.5	35.4	40.4	37.3
	20	53.9	43.4	25.9	12.7	31.7	25.6	48.2	52.4	27.4	27.0	28.5	42.2	38.6	42.3
	21	55.3	40.0	25.3	16.4	36.1	24.6	52.9	49.8	33.8	30.0	31.6	62.6	36.0	47.3
	22	55.5	40.2	24.8	23.8	39.9	34.9	61.2	51.7	33.0	29.6	36.4	70.2	38.6	50.3
	23	59.2	43.1	24.2	24.9	39.9	40.9	62.8	54.1	29.2	31.2	38.7	70.5	42.6	54.3
		MAY 30	MAY 31	JUN 1	JUN 2	JUN 3	JUN 4	JUN 5	JUN 6	JUN 7	JUN 8	JUN 9	JUN 10	JUN 11	JUN 12
PPBH<30		0	0	8	24	2	5	0	0	4	7	3	0	0	0
30>=PPBH<40		0	0	6		18	8	0	0	3	17	14	12	3	6
40>=PPBH<50		0	7	10		4	11	4	1	11		7	9	5	12
50>=PPBH<60		6	2					9	17	6			0	5	6
60>=PPBH<70		9	10					5	6				1	9	
70>=PPBH<80			5					6					2	2	
80>=PPBH<90															
90>=PPBH<100															
100>=PPBH<110															
110>=PPBH<120															
TOTAL HOURS		15	24	24	24	24	24	24	24	24	24	24	24	24	24

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DA		JUN 13	JUN 14	JUN 15	JUN 16	JUN 17	JUN 18	JUN 19	JUN 20	JUN 21	JUN 22	JUN 23	JUN 24	JUN 25	JUN 26
	0	57.2	52.4	64.8	52.5	55.5	59.0	30.5	33.9	31.8	39.1	44.1	30.3	51.8	54.1
	1	58.0	62.7	62.7	55.4	56.0	63.9	28.6	34.1	32.5	40.3	49.3	35.4	49.6	57.3
	2	61.1	46.3	56.6	59.9	57.8	63.5	31.3	34.8	30.0	41.2	51.4	40.9	47.8	59.1
	3	61.5	43.9	52.6	58.7	57.6	62.2	36.1	34.2	32.5	41.5	48.5	51.4	48.4	60.2
	4	60.7	51.3	56.4	57.2	58.4	60.9	43.4	32.8	35.8	40.6	46.9	59.3	49.9	58.2
	5	61.2	50.6	51.6	56.9	55.3	62.1	39.2	37.5	38.2	38.7	41.9	58.8	55.1	57.4
	6	65.1	49.7	47.1	61.2	53.2	60.3	37.5	38.5	42.3	35.7	41.1	61.3	60.0	58.3
	7	67.6	50.4	39.0	64.6	48.5	62.7	35.9	36.7	41.6	33.4	42.5	61.2	59.4	58.1
	8	73.8	26.8	36.0	48.5	36.9	54.9	31.2	25.0	42.6	37.3	38.2	62.7	56.4	62.8
	9	86.0	27.1	26.4	40.6	38.6	47.0	30.6	31.3	45.6	36.7	35.5	63.3	54.2	68.5
	10	65.1	30.1	34.2	48.1	42.6	43.7	30.3	37.6	51.9	36.8	34.6	65.6	53.7	77.4
	11	59.1	28.5	33.9	45.5	46.0	39.7	35.7	39.8	50.2	36.9	32.8	69.0	53.9	80.9
	12	63.7	29.7	35.0	37.6	44.4	34.3	36.8	42.0	40.2	39.1	30.8	64.7	49.6	76.4
	13	55.8	31.1	35.9	40.0	41.5	33.8	36.0	51.6	39.2	40.5	29.5	67.8	46.7	70.2
	14	52.5	22.8	32.7	41.9	38.0	31.0	35.2	48.3	40.8	39.9	33.1	67.0	42.6	62.8
	15	55.4	17.7	28.8	41.7	39.1	26.2	35.6	44.1	37.2	40.3	29.2	65.6	39.4	60.8
	16	55.6	19.5	34.5	41.4	27.9	27.4	36.5	34.9	36.4	37.9	32.0	65.0	37.7	52.8
	17	48.0	20.2	36.4	42.2	26.0	29.8	35.7	28.9	35.3	37.4	29.4	64.7	36.7	46.7
	18	40.9	25.1	36.8	42.6	23.3	27.2	35.0	32.6	33.7	33.8	26.2	64.5	35.6	61.6
	19	42.0	32.4	34.1	33.1	20.2	25.7	32.5	34.0	34.7	32.1	20.2	61.5	36.4	60.0
	20	38.9	29.5	29.4	30.6	27.3	32.3	31.4	30.1	33.1	36.7	22.2	60.9	39.6	59.9
	21	38.9	54.5	49.4	44.6	39.0	33.3	31.5	29.1	33.9	42.3	19.9	57.8	43.3	56.8
	22	44.7	59.5	60.3	54.4	47.9	34.7	31.1	31.7	33.7	42.0	20.7	54.2	48.0	57.0
	23	44.8	63.4	57.8	55.7	54.3	30.0	34.9	33.2	37.3	40.8	31.7	52.8	51.0	57.4
		JUN 13	JUN 14	JUN 15	JUN 16	JUN 17	JUN 18	JUN 19	JUN 20	JUN 21	JUN 22	JUN 23	JUN 24	JUN 25	JUN 26
PPBH<	0	0	10	3	0	5	5	1	3	0	0	8	0	0	0
	H<40	2	3	11	3	5	8	22	17	16	15	8	2	6	0
	H<50	5	3	2	11	6	2	1	3	6	9	7	1	9	1
	H<60	7	6	5	8	8	2		1	2		1	6	8	12
	H<70	8	2	3	2		7						15	1	7
	H<80	1													3
	H<90	1													1
90	H<100														
	H<110														
0>=PPBH<120															
OTAL HOURS		24	24	24	24	24	24	24	24	24	24	24	24	24	24

4

DATE	JUN 27	JUN 28	JUN 29	JUN 30	JUL 1	JUL 2	JUL 3	JUL 4	JUL 5	JUL 6	JUL 7	JUL 8	JUL 9	JUL 10
	70.2	25.8	54.1	55.2	34.0	57.6	25.1	37.9	53.8	55.0	49.7	55.4	60.8	44.3
	62.8	27.8	60.6	56.9	35.0	61.4	26.7	38.3	57.5	57.4	57.4	58.0	63.0	43.5
	60.8	34	59.7	51.3	35.6	64.7	28.9	38.6	61.7	60.1	56.9	57.8	61.1	42.4
	52.8	38.3	56.5	50.6	38.7	63.2	32.1	38.9	63.3	55.1	56.1	56.5	61.4	42.1
	46.7	41.1	54.8	52.3	45.8	64.7	33.6	39.9	60.3	60.4	58.2	52.7	56.7	44.2
	61.6	43.9	48.6	49.3	46.7	63.8	35.3	39.2	58.2	58.9	61.9	53.4	52.6	43.9
	60.0	45	42.2	48.2	46.2	60.4	39.7	41.7	62.2	59.3	49.8	55.5	66.5	42.2
	59.9	42.4	54.1	44.1	45.0	61.6	37.1	40.6	68.2	58.5	50.1	54.8	67.7	33.1
	56.8	27.5	51.4	44.6	43.1	65.7	23.9	28.3	71.7	45.8	45.3	39.8	57.3	33.2
	57.0	16.9	57.3	42.8	32.7	68.6	23.5	24.3	75.7	46.7	35.9	50.4	50.8	33.4
	57.4	18.9	57.9	40.7	26.8	63.4	29.2	29.1	71.9	51.4	38.9	55.1	46.9	29.9
	59.4	19.4	56.8	38.3	26.1	61.7	32.6	30.8	65.0	50.8	37.5	40.0	50.5	23.6
	58.8	15.8	50.8	40.9	24.3	54.9	32.6	32.1	61.6	42.1	36.4	37.6	53.6	18.4
	60.3	14.8	48.2	43.8	26.5	47.0	29.4	36.3	60.3	39.3	31.8	50.6	50.7	16.3
	60.3	16.0	47.5	41.1	21.8	38.1	29.7	40.5	57.4	38.5	30.6	48.2	40.2	14.8
	58.7	18.9	37.6	41.6	23.2	48.5	32.1	50.1	56.5	30.4	28.7	53.4	34.2	16.0
	51.8	18.9	36.6	41.8	24.0	29.3	33.7	52.6	53.7	31.6	30.1	53.1	32.8	16.8
	43.6	17.8	46.6	41.9	20.8	17.4	34.6	51.4	53.1	32.7	28.6	44.0	31.5	16.2
	42.8	18.4	48.4	42.3	22.4	16.4	29.0	50.5	50.9	39.1	28.7	49.8	30.1	16.6
	46.2	16.2	43.6	41.2	25.7	12.3	23.3	50.5	48.1	35.0	23.8	42.9	30.4	16.6
	43.7	16.4	38.7	35.9	34.9	12.7	22.0	48.7	50.0	33.0	21.4	41.5	35.0	16.7
	43.5	42.7	44.8	33.6	42.6	16.4	22.4	48.0	52.5	40.0	43.0	55.0	35.4	16.4
	44.7	52.2	50.5	33.2	43.4	20.4	32.3	49.3	52.8	50.5	43.8	53.9	39.4	18.8
	42.6	55.3	51.7	32.9	52.6	22.7	36.0	49.5	52.4	51.2	52.1	58.1	42.1	21.4
	JUN 27	JUN 28	JUN 29	JUN 30	JUL 1	JUL 2	JUL 3	JUL 4	JUL 5	JUL 6	JUL 7	JUL 8	JUL 9	JUL 10
PPBH<30	0	15	0	0	10	8	12	3	0	0	5	0	0	14
30>=PPBH<40	0	2	3	5	6	1	12	9	0	8	7	2	8	3
40>=PPBH<50	8	5	8	14	7	2		7	1	4	5	6	3	7
50>=PPBH<60	9	2	12	5	1	2		5	12	10	6	16	7	
60>=PPBH<70	6		1			11			8	2	1		6	
70>=PPBH<80	1								3					
80>=PPBH<90														
90>=PPBH<100														
100>=PPBH<110														
110>=PPBH<120														
TOTAL HOURS	24	24	24	24	24	24	24	24	24	24	24	24	24	24

Mt. Equinox, VT Mean Hourly Ambient Ozone Levels for 1994

DATE	JUL 11	JUL 12	JUL 13	JUL 14	JUL 15	JUL 16	JUL 17	JUL 18	JUL 19	JUL 20				JUL 24
HOUR 0	16.6	41.5	68.7	23.3	39.6	32.8	28.8	47.8	47.8	31.1	30.9	39.8		22.5
1	16.2	44.7	65.2	22.0	43.2	35.2	28.2	49.6	39.8	33.9	29.9			22.6
2	17.1	42.1	61.6	21.4	39.3	37.3	26.4	61.0	45.9	36.0	29.9			22.1
3	15	44.4	61.8	21.1	41.7	37.8	28.0	43.8	54.4	31.7	35.6			22.9
4	17.2	47.5	61.5	17.6	42.5	38.3	24.2	42.2	53.0	30.3	33.2	16.7		22.8
5	16.8	47.8	56.8	14.5	43.2	38.8	27.8	57.0	52.0	28.4	27.5	16.4		
6	18.5	48.4	54.9	22.9	46.8	40.8	34.2	57.1	49.5	24.3	28.1	17.0	27.7	20.7
7	20.3	51.6	56.0	26.8	45.4	40.2	39.6	53.5	49.3	19.9	35.2	19.2	28.2	19.9
8	19.9	50.6	56.8	32.6	45.0	43.5	40.8	33.9	51.5	22.2	42.1	19.7	26.1	21.5
9	22.3	54.2	53.9	33.4	39.9	47.2	40.1	42.1	50.4	27.5	42.5	20.7		
10	25.4	54.7	57.9	34.1	35.7	47.6	36.6	49.5	55.2	43.7	44.1		24.0	
11	29.8	57.4	58.2	38.1	44.8	49.1	38.5	54.5	37.8	52.5	41.7	23.7		
12	31.6	58.6	58.3	34.7	34.5	41.0	34.0	54.9	44.4	55.7	41.2	26.9		
13	30.7	62.2	55.8	34.0	27.7	47.3	31.4	57.0	40.2	56.9	42.3	33.6		
14	30.4	66.0	52.0	31.5	29.7	44.8	32.8	58.8	46.4	55.9	46.9			
15	29.6	65.1	48.8	33.3	33.5	43.0	44.1	58.9	50.1	55.5	46.8	36.5	29.0	36.1
16	31.9	64.9	47.3	37.5	36.0	41.6	49.9	58.6	49.4	55.0	41.2	35.0	27.8	36.5
17	32.2	63.6	44.0	36.0	32.1	36.3	61.8	61.6	48.9	55.4	40.9	44.1	27.4	36.6
18	27.2	59.1	42.3	36.5	22.1	31.6	66.8	57.3	47.9	54.3	45.0	45.1	29.7	
19		56.4	37.8	52.6	25.0	31.7	65.2	58.7	39.8	52.9	49.4	43.1	29.8	
20		59.4	33.4	53.6	30.8	29.1	62.3	60.8	30.6	45.8	48.4	46.8	30.0	17.1
21		57.1	30.0	56.0	36.5	35.1	58.2	59.0	32.4	38.9	53.5	40.2	28.7	22.7
22	36.3	61.6	25.2	49.0	31.6	27.7	56.6	58.5	33.0	29.3	63.2	31.8	26.3	20.3
23	37.6	67.2	24.2	42.5	32.2	28.5	56.2	56.9	33.4	27.4	54.7	25.4	27.5	16.9

	JUL 11	JUL 12	JUL 13	JUL 14	JUL 15	JUL 16	JUL 17	JUL 18	JUL 19	JUL 20	JUL 21	JUL 22	JUL 23	
PPBH<30	14	7	2	8	4	3	6	0	7	7	4	12	18	17
30>=PPBH<40	7	10	3	11	12	10	7	1	10	6	4	7	6	7
40>=PPBH<50		7	4	2	8	11	4	6	7	2	13	5		
50>=PPBH<60			10	3			3	14		9	2			
60>=PPBH<70			5				4	3			1			
70>=PPBH<80														
80>=PPBH<90														
90>=PPBH<100														
100>=PPBH<110														
110>=PPBH<120														
TOTAL HOURS	21	24	24	24	24	24	24	24	24	24	24	24	24	24

Mt. Equinox, VT Mean Hourly Ambient Ozone Levels for 1994

DATE		JUL 25	JUL 26	JUL 27	JUL 28	JUL 29	JUL 30	JUL 31	AUG 1	AUG 2	AUG 3	AUG 4	AUG 5	AUG 6	
HOUR	0	19.6	19.4	21.2	15.9	11.8	16.0	24.3	20.6	11.4	31.1	46.9	65.1	16.4	15.4
	1	31.3	19.2	19.5	18.0	12.2	17.7	28.8	17.2	10.4	28.4	44.4	62.3	16.7	15.8
	2	19.8	18.2	19.6	16.2	17.5	14.6	29.5	15.3	10.7	26.8	32.9	58.8	15.5	15.6
	3	14.6	17.4	20.2	25.6	16.1	12.3	30.3	15.3	11.4	29.5	33.6	56.9	17.2	16.7
	4	14.9	26.5	19.0	36.0	12.9	11.2	28.3	15.1	11.3	28.9	26.3	56.8	17.3	15.2
	5	18.1	26.0	16.3	37.2	9.4	11.4	19.7	13.2	8.9	29.8	35.8	50.4	16.1	15.9
	6	15.6	27.4	13.8	35.6	12.6	21.2	25.8	13.9	11.1	47.4	43.8	44.1	17.2	16.1
	7	16.8	26.3	15.3	34.0	14.9	20.2	24.9	29.2	16.3	52.8	47.9	33.7	18.9	14.4
	8	25.7	26.4	17.7	28.1	16.8	37.8	30.9	35.2	20.7	49.8	57.7	29.4	20.4	25.8
	9	28.0	35.3	18.0	20.3	20.3	34.2	32.9	38.0	24.2	51.7	60.3	16.5	21.5	28.3
	10	29.8	38.8	18.4	19.2	26.6	31.9	32.0	42.4	27.7	54.1	65.8	12.4	24.2	28.3
	11	32.6	38.9	19.3	20.7	28.7	31.6	30.5	46.1	31.0	55.7	70.2	12.8	25.5	27.7
	12	34.3	44.2	20.6	23.0	29.9	32.4	30.3	47.7	31.4	57.0	70.9	14.5	25.9	28.0
	13	35.2	40.0	23.0	25.0	31.2	34.0	30.4	45.9	36.7	58.8	68.0	16.2	26.5	27.6
	14	38.3	38.2	24.4	20.8	30.9	35.5	31.4	45.3	69.9	61.9	71.5	19.2	25.8	28.4
	15	40.4	40.0	24.7	12.9	32.0	36.0	31.5	43.4	53.6	63.6	77.7	17.9	27.3	28.1
	16	28.5	49.8	19.3	12.3	31.7	34.9	27.6	42.5	39.6	61.1	79.8	19.0	27.7	26.1
	17	39.9	52.7	12.9	15.1	29.1	22.0	26.4	46.1	46.1	55.5	81.3	20.2	25.0	18.2
	18	40.1	44.7	10.1	15.9	18.2	22.0	18.8	44.9	47.8	40.5	76.5	19.8	20.1	14.2
	19	32.4	40.8	12.1	17.1	16.0	27.3	23.0	35.1	39.7	35.5	73.4	20.4	14.8	16.9
	20	24.4	39.9	13.3	14.9	19.7	36.0	25.2	26.0	32.7	36.6	79.9	20.3	15.3	17.1
	21	27.0	32.4	13.5	14.7	21.7	26.2	26.2	17.3	36.9	32.7	78.4	19.0	15.3	17.4
	22	24.6	26.2	15.1	18.2	19.8	26.6	25.0	19.6	35.6	28.8	72.1	16.6	16.0	19.3
			22.1	14.3	17.1	18.6	25.1	22.1	14.9	36.2	30.7	68.5	15.5	15.5	18.7

	JUL 25	JUL 26	JUL 27	JUL 28	JUL 29	JUL 30	JUL 31	AUG 1		AUG 3	AUG 4	5	AUG 6	AUG 7
	15	11		20	20	14	15	12	11	6	1	16	24	24
	7	6		4	4	10	9	3	9	5	3	1		
40>=PPBH<50	2	6						9	2	3	4	1		
50>=PPBH<60									1	7	1	4		
60>=PPBH<70									1	3	4	2		
70>=PPBH<80											10			
80>=PPBH<90											1			
90>=PPBH<100														
100>=PPBH<110														
110>=PPBH<120														
		24	24	24	24	24	24	24	24					24

Mt. Equinox, VT Mean Hourly Ambient Ozone Levels for 1994

DATE	AUG 8	AUG 9	AUG 10	AUG 11	AUG 12	AUG 13	AUG 14	AUG 15	AUG 16	AUG 17	AUG 18	AUG 19	AUG 20	AUG 21
HOUR 0	19.1	58.5	43.6	17.1	16.3	44.4	39.7	28.1	17.2	17.4	13.0	19.7	7.4	
1	20.0	42.7	41.4	16.0	17.0	42.3	41.9	25.8	19.8	17.8	23.0	19.2	7.2	
2	23.4	39.9	38.3	16.4	14.1	37.1	44.0	23.4	17.3	25.3	23.9	19.0	15.4	
3	24.6	37.5	34.0	16.1	19.6	40.1	45.8	22.8	15.0	21.4	23.3	17.7	13.3	
4	23.8	33.9	30.9	15.8	20.5	46.4	45.5	22.9	15.1	22.4	25.3	16.5	11.5	48.3
5	19.7	31.6	23.6	14.8	20.5	49.4	46.1	23.2	13.2	19.9	26.4	13.2	15.4	46.9
6	18.7	52.4	21.0	16.6	17.6	38.4	45.1	20.2	11.9	23.2	27.8	15.0	19.8	47.2
7	36.6	63.5	20.2	25.6	19.7	39.1	45.6	18.8	22.9	18.7	28.8	16.9	28.2	47.6
8	39.0	63.4	20.5	24.7	30.9	40.3	45.4	18.4	26.3	25.6	30.0	18.5	34.8	45.0
9	38.8	63.7	21.4	25.0	34.0	46.9	43.8	19.3	28.3	41.2	24.1	20.2	41.3	43.8
10	40.4	62.9	24.8	23.6	37.2	50.0	40.8	21.0	30.1	42.2	24.3	20.1	49.4	44.2
11	41.6	64.3	29.7	26.4	38.2	49.6	38.4	20.9	32.9	41.8	24.7	19.5	52.4	43.2
12	42.8	65.4	30.6	29.0	39.5	47.8	39.8	21.7	36.9	40.9	26.2	21.7	56.8	45.0
13	46.9	67.6	30.6	30.2	41.1	49.1	40.1	20.4	42.4	43.9	20.9	23.0	61.0	41.9
14	49.6	67.6	30.6	33.0	43.6	44.4	39.2	19.6	45.6	42.7	21.2	22.5	64.8	42.1
15	52.3	58.4	32.3	37.8	42.2	42.3	38.4	19.6	46.0	41.1	18.1	22.0	60.6	41.8
16	53.1	52.0	29.2	39.3	44.4	40.7	35.4	20.8	45.8	34.7	19.1	21.8	62.0	41.5
17	40.9	52.9	23.0	35.6	35.3	38.3	30.0	21.0	37.6					36.4
18	32.1	43.9	15.2	29.6	26.2	37.8	29.8	20.4	23.9					28.5
19	36.3	54.2	14.8	25.3	38.2	38.3	33.2	19.4	21.0					23.3
20	32.4	46.2	19.1	20.0	41.3	40.3	31.9	21.3	20.7					22.5
21	29.7	49.5	17.8	19.6	51.4	40.8	30.0	21.5	19.0	10.8	20.6	11.3	68.0	20.7
22	32.5	49.9	16.4	19.3	53.7	39.4	29.0	16.9	16.7	12.9	20.0	7.9	60.9	15.6
23	47.9	45.4	15.7	16.4	49.8	39.8	28.4	18.8	18.1			7.9	57.5	16.6

	AUG 8	AUG 9	AUG 10	AUG 11	AUG 12	AUG 13	AUG 14	AUG 15	AUG 16	AUG 17	AUG 18	AUG 19	AUG 20	AUG 21
PPBH<30	8	0	15	19	9	0	3	24	16	15	23	24	8	6
30>=PPBH<40					7	8	10		4	2	1		1	1
40>=PPBH<50					6	15	11		4	7			2	14
50>=PPBH<60					2	1							3	2
60>=PPBH<70													10	1
70>=PPBH<80														
80>=PPBH<90														
90>=PPBH<100														
100>=PPBH<110														
110>=PPBH<120														
TOTAL HOURS	24	24	24	24	24	24	24	24	24	24	24	24	24	24

DATE		AUG 22	AUG 23	AUG 24	AUG 25	AUG 26	AUG 27	AUG 28	AUG 29	AUG 30	AUG 31	SEP 1
HOUR	0	17.4	21.7	19.9	21.4	27.8	32.7	20.6	39.7	29.8	20.3	23.9
	1	28.3	22.7	17.9	19.8	31.8	34.5	19.3	33.6	28.1	18.5	24.0
	2	35.4	21.2	19.1	18.5	32.8	41.5	18.5	29.3	25.0	18.2	25.8
	3	30.6	20.7	22.7	21.9	21.3	41.1	23.1	26.4	20.7	17.0	23.9
	4	26.9	15.1	22.0	22.8	20.4	38.1	15.6	25.4	17.4	18.9	24.1
	5	25.2	11.5	19.7	22.1	17.1	35.8	16.2	24.8	15.6	19.5	23.9
	6	21.6	12.0	19.8	32.2	19.8	33.5	13.9	22.8	14.6	17.3	22.4
	7	21.6	19.8	18.9	49.2	39.4	33.1	30.2	23.4	19.2	22.8	21.6
	8	22.1	21.4	20.1	55.6	40.0	36.0	40.2	23.0	22.6	24.4	22.7
	9	19.3	22.7	30.0	58.0	40.8	37.5	42.2	24.0	59.5	28.3	18.7
	10	17.3	26.5	30.5	58.0	41.2	38.6	49.1	24.7	26.6	29.1	15.1
	11	17.2	26.6	30.3	58.4	43.0	39.9	49.7	25.0	27.9	32.3	17.6
	12	17.4	27.1	31.9	60.5	47.1	39.7	49.0	25.2	27.8	32.7	23.3
	13	17.1	27.7	30.8	63.5	48.7	38.0	51.5	25.8	27.6	31.5	24.3
	14	16.0	29.2	32.1	64.4	50.8	37.9	50.4	27.4	29.2	34.2	27.5
	15	16.4	29.5	32.6	60.8	54.8	38.3	50.6	26.9	29.2	20.2	27.9
	16	16.5	29.0	30.6	50.3	56.8	33.1	52.7	27.5	28.7	12.9	
	17	17.7	23.8	16.6	60.6	59.1	26.4	55.5	26.5	30.2	21.3	
	18	24.5	14.4	14.9	44.7	35.0	14.9	56.2	26.5	26.3	16.7	
	19	29.1	23.2	16.6	45.1	27.6	18.7	55.3	26.2	21.7	17.6	
	20	22.6	22.0	17.4	45.2	24.8	17.6	54.4	27.8	19.0	25.5	
	21	20.0	18.8	16.2	47.3	20.3	19.0	50.1	29.7	19.0	16.0	
	22	18.3	15.3	17.5	44.7	29.5	21.9	49.9	29.9	18.4	32.2	
	23	20.2	16.6	19.7	31.7	39.3	22.2	45.5	30.8	18.7	29.9	

	AUG 22	AUG 23	AUG 24	AUG 25	AUG 26	AUG 27	AUG 28	AUG 29	AUG 30	AUG 31	SEP 1	SUM BY ROW
PPBH<30	22	24	16	6	9	7	7	21	22	19	16	816
30>=PPBH<40	2		8	2	5	15	1	3	1	5		532
40>=PPBH<50				6	6	2	7		0			415
50>=PPBH<60				5	4		9		1			294
60>=PPBH<70				5								167
70>=PPBH<80												33
80>=PPBH<90												3
90>=PPBH<100												0
100>=PPBH<110												0
110>=PPBH<120												0
TOTAL HOURS	24	24	24	24	24	24	24	24	24	24	16	2260