

APPENDIX D

RESULTS OF LAWN AND GARDEN EQUIPMENT ACTIVITY SURVEYS

The purpose of this appendix is to characterize and describe the responses to the lawn and garden equipment usage survey. Survey respondents were randomly selected through the SoCAB from a database of landscape businesses and facilities likely to use landscape equipment (e.g., parks, schools, golf courses, etc.).

The overall findings show that work activity is reduced by at least 80-90% on weekends relative to weekdays. Working hours tend to begin around 6:00-7:00 a.m. and end at around 2:30-4:30 p.m., regardless of the day of week. Summary tables of survey responses are shown below.

Table D-1. Number of respondents by land-use category.

Table D-2. Types of property maintained by survey respondents.

Table D-3. Number of properties serviced by survey respondents.

Table D-4. Number and types of landscape maintenance equipment.

Table D-5. Number of respondents and types of chemicals used for landscape maintenance.

Table D-6. Day-of-week usage pattern for landscape maintenance chemicals.

Table D-7. Frequency of use of landscape maintenance chemicals.

Table D-8. Application time required for landscape maintenance chemicals.

Table D-9. Land area serviced by respondents.

Table D-10. Number of workers employed daily by respondents.

Table D-11. Number of businesses with weekend shifts.

Table D-12. Number of workers by day of week and time of day.

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Table D-1. Number of respondents by land-use category.

Respondent Category	No. Respondents	Percent of Total
Airports	3	2.0%
Campgrounds	6	4.0%
Camps (recreational areas)	3	2.0%
Cemetery	16	10.6%
Golf private	5	3.3%
Golf public	16	10.6%
Land (Contractors)	68	45.0%
Parks	22	14.6%
School/Univ./College	12	7.9%
Total (percentage s rounded)	151	100.00%

Table D-2. Types of property maintained by survey respondents.

		Types of Non-Residential Properties Served (No. "yes" responses)						
Number Respondents	General Types of Clients Served by Respondents	Schools, colleges or universities	Cemeteries	Golf courses	Parks and Rec areas	Business parks or commercial spaces	Airports or Transportation facilities	Residential park
16	Residential properties only							
90	Non-residential properties only (commercial, government-owned, or public)	15	16	23	23	15	7	2
44	Both residential and non-residential properties	10	4	4	11	37		3
1	DON'T KNOW	0	0	0	1	1		
151	Total	25	20	27	35	53	7	5

Table D-3. Number of properties serviced by survey respondents.

Number Respondents	General Types of Clients Served by Respondents	Total No. Properties Served Weekly	Avg. Properties per Respondent per Week
16	Residential properties only	714	45
90	Non-residential properties only (commercial, government-owned, or public)	1421	16
44	Both residential and non-residential properties	2791	63
1	DON'T KNOW	1	1
151	Total		

Table D-4. Number and types of landscape maintenance equipment.

Type of Equipment	Total Respondents Who Use			Equipment Count			
	yes	no	don't know	Gasoline-powered	Diesel-powered	Electric	Manual
Edgers/trimmers/Cutters	142	9		1540	90	112	295
Mowers	141	9	1	1940	313	6	26
Tractors	84	67		575	284	0	0
Chainsaws	106	45		966	88	92	99
Commercial Turf Equipment	68	82	1	1417	237	95	92
Leaf Blowers	128	23		1287	177	192	177

Table D-5. Number of respondents and types of chemicals used for landscape maintenance.

Chemicals Used	Total Respondents Who Use
Fertilizers only	60
Pesticides only	1
Both fertilizers and pesticides	60
None	29
DON'T KNOW	1

Table D-6. Day-of-week usage pattern of landscape maintenance chemicals.

Days Used	No. of Responses	
	Pesticides	Fertilizers
Only used Monday through Friday	43	72
Only used Saturday or Sunday	2	3
More likely used Monday through Friday than on the weekend	3	14
More likely used Saturday or Sunday than during the week	10	2
Used any day of the week	0	24
DON'T KNOW	3	4
REFUSED	1	1

Table D-7. Frequency of use of landscape maintenance chemicals.

Frequency of Use	No. of Responses	
	Pesticides	Fertilizers
Daily to weekly	3	5
Weekly to monthly	7	8
Monthly to bimonthly	9	26
Only once or twice per summer	36	74
DON'T KNOW	2	1

Table D-8. Application time required for landscape maintenance chemicals.

No. Days Required for a Single Application	No. of Responses	
	Pesticides	Fertilizers
1	50	92
2	5	9
3	1	4
4	1	1
5	0	2
10	0	1
30	0	1
180	1	0
Don't Know	0	4
Refuse	0	1

Table D-9. Land area serviced by respondents.

Total Area Served in a Typical Summertime Week	No. Responses
Less than 1 acre	16
1-10 acres	24
11-50 acres	48
51-250 acres	34
251-1,000 acres	10
1,001-5,000 acres	6
>5000 acres	2
DON'T KNOW	11

21,000 to 71,000 acres/week are represented by the sampled respondents (or 33 to 111 square miles). Los Angeles County is 4,100 square miles. Thus, the sample represents 1-3% of the total land area of LA County.

Table D-10. Number of workers employed daily by respondents.

Number of Workers Employed On a Typical Summer Workday	No. of Responses
1	16
2	20
3 to 4	21
5 to 6	19
7 to 10	18
11 to 15	16
16 to 25	24
26 to 50	6
51 to 100	3
101 to 200	4
300	1
1000	1
Don't know	1
Refused	1

Total no. of workers reported on duty: 3,549.

Table D-11. Number of businesses with weekend shifts.

Does this business have weekend shifts for lawn/garden workers?	No. of Responses
Saturday Only	30
Sunday Only	1
Both Saturday and Sunday	43
Neither	74
Don't Know	2
Refuse	1

Table D-12. Number of workers by day of week and time of day.

Day of Week	Number of Workers Reported On Duty						est. man-hrs
	4am - 8am	8am - noon	Noon - 4pm	4pm - 8pm	8pm - midnight	midnight - 4 am	
Weekday ^a	1256	2007	1821	111	8	25	20,912
Saturday	199	401	304	13	3	9	3,716
Sunday	214	218	154	13	2	1	2,408

^a Includes 126 respondents whose shifts were the same on all 5 weekdays. For simplicity, excludes 22 respondents whose shifts varied by weekday. The excluded businesses employed 318 workers on a typical weekday, of 3,549 reported for the whole data set.

APPENDIX E

RESULTS OF RESIDENTIAL ACTIVITY SURVEYS

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E-1. BARBECUES

Barbecuing is characterized as a leisure activity; therefore, the expectation is that barbecues occur much more frequently on the weekend as opposed to on weekdays in residential areas. As shown in **Table E-1**, 48% of barbecuing, and, therefore emissions, occur on the weekend, and 73% of all barbecuing occurs in the evening.

Table E-1. Barbecue activity by day of week and time of day (morning, afternoon, evening).

DAY OF WEEK	% OF WEEKLY ACTIVITY	% MORNING	% AFTERNOON	% EVENING
M	11%	-	10%	90%
T	6%	20%	-	80%
W	16%	7%	7%	86%
Th	9%	11%	22%	67%
F	10%	-	12%	88%
S	25%	7%	39%	54%
S	23%	7%	48%	45%
-	Average	7%	20%	73%

The variation in barbecue activity by neighborhood (see **Table E-2**) shows that barbecuing is an activity that can vary greatly by location within the SoCAB. For example, respondents near the Pico Rivera site use barbecues 40% more often than respondents near the Azusa site. The time of day that barbecues occur is also different. Azusa and Industrial Hills show one type of pattern in which roughly 20% of barbecues occur in the afternoon and 80% in the evening. Conversely, Los Angeles N. Main and Pico Rivera show a pattern in which barbecues occur slightly more often in the afternoon (47%) as opposed to the evening (41%). Los Angeles N. Main and Pico Rivera also show significant levels of barbecuing in the morning.

Table E-2. Barbecue activity by location and by time-of-day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	5.2%	-	19%	81%
Industrial Hills	7.7%	2%	20%	78%
Los Angeles N. Main	6.1%	12%	48%	40%
Pico Rivera	8.3%	14%	46%	41%

E-2. CONSUMER PRODUCTS

Consumer products include hair sprays, dyes, nail polishes, polish removers, etc. As shown in **Table E-3**, residents report using consumer products fairly uniformly throughout the week. There is a slightly higher use on Friday (17%) compared to the daily average and slightly

less use on Sunday (12%). Consumer products are most often used in the morning (70%), and less often in the afternoon (14%) and evening (16%).

Table E-3. Use of consumer products by day-of-week and time-of-day.

DAY OF WEEK	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
M	15%	76%	11%	13%
T	14%	74%	11%	15%
W	15%	68%	16%	17%
Th	14%	70%	12%	17%
F	17%	66%	15%	19%
S	14%	68%	18%	15%
S	12%	71%	15%	14%
-	Average	70%	14%	16%

As shown in **Table E-4**, Industrial Hills residential respondents use consumer products 70% more than residential respondents in Pico Rivera. The time of day that consumer products are used varies by location. For example, Pico Rivera residents report no use in the evening. Conversely, Los Angeles N. Main residents report 21% of consumer product use is in the evening.

Table E-4. Consumer product activity by zone by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	32%	78%	6%	16%
Industrial Hills	39%	68%	17%	15%
Los Angeles N. Main	31%	57%	22%	21%
Pico Rivera	23%	82%	18%	-

E-3. ENGINE OILS

Residential use of engine oils includes motor oils, gear oils or fluids, or brake fluids is shown in **Table E-5**. Engine oils are used about twice as often on Wednesday (26%) and Saturday (20%) than the rest of the week. Engine oils are most often used in the morning (36%) and afternoon (41%) and less often in the evening (23%).

Table E-5. Use of engine oils by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
M	10%	0%	50%	50%
T	12%	40%	20%	40%
W	26%	45%	36%	18%
Th	12%	40%	60%	0%
F	10%	40%	40%	20%
S	20%	50%	39%	11%
S	11%	33%	44%	22%
-	Average	36%	41%	23%

The variation in engine oil activity by location (**Table E-6**) underscores the fact that residential activities can vary greatly by location within the SoCAB. As shown in Table E-6, Industrial Hills residents use engine oil three times more often than residents in other zones. The time of day that engine oil products are used also varies by location. For example, Pico Rivera residents report no use in the evening. Conversely, Los Angeles N. Main residents report 30% of engine oil use is in the evening.

Table E-6. Use of engine oil by location and by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	1.6%	36%	45%	18%
Industrial Hills	2.1%	42%	42%	17%
Los Angeles N. Main	6.4%	33%	37%	30%
Pico Rivera	2.1%	67%	33%	-

E-4. FIREPLACES

As shown in **Table E-7**, fireplaces are used more often on Wednesday (20%) and Saturday (23%). Fireplaces are least often used on Monday (7%) and Friday (7%). Fireplaces are most often used in the morning (52%). The results of the survey for fireplace use is particularly subject to a high degree of uncertainty because the survey period included an unusually rainy and cool period during the week with warmer days on the weekends.

Table E-7. Use of fireplace by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	7%	100%	-	-
T	13%	50%	50%	-
W	20%	33%	33%	33%
Th	13%	50%	-	50%
F	7%	67%	33%	-
S	23%	25%	13%	63%
S	17%	40%	20%	40%
-	Average	52%	21%	27%

As shown in **Table E-8**, residential respondents near the Los Angeles N. Main site use fireplaces 10 times more often than residents in Azusa. The time of day that fireplaces are used is also different by location. For example, Pico Rivera residents report no use in the evening while Los Angeles N. Main residents report 30% of fireplace use is in the evening.

Table E-8. Use of fireplace by zone by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	0.3%	36%	45%	18%
Industrial Hills	0.5%	42%	42%	17%
Los Angeles N. Main	3.2%	33%	37%	30%
Pico Rivera	1.0%	67%	33%	-

E-5. GASOLINE POWERED LAWN EQUIPMENT

As shown in **Table E-9**, gasoline-powered lawn equipment is used most often on Friday (20%) and Saturday (20%) and least often on Tuesday (8%). Gasoline-powered lawn equipment is most often used in the morning (49%) and afternoon (42%) and less often in the evening (8%).

Table E-9. Operation of gasoline powered equipment by day of week and time of day (morning, afternoon, evening).

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	14%	67%	25%	8%
T	8%	63%	38%	-
W	11%	56%	44%	-
Th	14%	25%	58%	17%
F	20%	40%	57%	3%
S	20%	44%	41%	15%
S	11%	50%	33%	17%
-	Average	49%	42%	8%

The use of gasoline-powered lawn equipment varies by location (see **Table E-10**). For example, Industrial Hills residents use lawn equipment twice as often as residents near Los Angeles N. Main and Pico Rivera. The time of day that lawn equipment is used is also somewhat different. For example, Azusa and Pico Rivera residents report 5% use in the evening. Conversely, Industrial Hills and Los Angeles N. Main residents report 15% use or three times as much use in the evening.

Table E-10. Use of gasoline-powered lawn equipment by location and by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	5.4%	53%	42%	5%
Industrial Hills	8.7%	37%	49%	14%
Los Angeles N. Main	4.2%	45%	40%	15%
Pico Rivera	4.9%	58%	37%	5%

E-6. PAINTS AND SOLVENTS

As shown in **Table E-11**, paints and solvents are applied slightly more often on Thursday (17%) and Saturday (16%) relative to the rest of the week (13%). Paints and solvents are most often applied in the morning (40%) and afternoon (47%) and less often in the evening (12%).

Table E-11. Application of paints and solvents by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	15%	30%	70%	0%
T	13%	78%	11%	11%
W	13%	42%	42%	17%
Th	17%	33%	47%	20%
F	13%	32%	47%	21%
S	16%	30%	57%	13%
S	13%	36%	59%	5%
-	Average	40%	47%	12%

As shown in **Table E-12**, Industrial Hills and Los Angeles N. Main residents apply paint and solvent almost three times more often than Azusa and Pico Rivera residents. The time of day that paints and solvents are applied is also different. For example, Azusa reports 62% use in the afternoon compared to 31% by Pico Rivera. Industrial Hills and Pico Rivera respondents report 22% and 19% of their activity occur in the evening as opposed to Los Angeles N. Main with no activity.

Table E-12. Application of paints and solvents by zone by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	2.3%	33%	62%	5%
Industrial Hills	6.2%	24%	54%	22%
Los Angeles N. Main	5.9%	54%	46%	-
Pico Rivera	2.1%	50%	31%	19%

E-7. PAVING MATERIALS (ASPHALT AND TAR)

As shown in **Table E-13**, there is some variation in the use of paving material by day of week. While the greatest activity occurred on Monday (19%), Thursday (19%), and Saturday (19%), this result is based on a small number of residents who reported using paving material. We do not have much confidence that this day-of-week pattern will be consistent with a larger dataset. Nevertheless, paving materials were most often applied in the morning (69%) and less often in the afternoon (20%) and evening (11%).

Table E-13. Use of paving material (asphalt and tar) by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	19%	100%	-	-
T	10%	100%	-	-
W	10%	100%	-	-
Th	19%	-	50%	50%
F	10%	100%	-	-
S	19%	50%	25%	25%
S	14%	33%	67%	-
-	Average	69%	20%	11%

As shown in **Table E-14**, Azusa and Industrial Hills residents applied paving materials six to seven times more often than Pico Rivera residents. The time of day that paving materials are applied is somewhat different, but the number of residential respondents who reported using paving materials is small.

Table E-14. Use of paving material by zone by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	2.9%	50%	50%	-
Industrial Hills	3.4%	-	100%	-
Los Angeles N. Main	2.0%	75%	12%	12%
Pico Rivera	0.5%	100%	-	-

E-8. PESTICIDE APPLICATIONS

As shown in **Table E-15**, pesticides and fertilizers are applied more often on Friday (22%) and Saturday (22%) and least often on Wednesday (3%). Pesticides and fertilizers are most often applied in the morning (37%) and evening (42%) and less often in the afternoon (21%).

Table E-15. Applications of pesticides and fertilizers by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	9%	33%	33%	33%
T	14%	40%	20%	40%
W	3%	-	-	100%
Th	14%	40%	20%	40%
F	22%	40%	13%	47%
S	16%	45%	18%	36%
S	22%	60%	40%	-
-	Average	37%	21%	42%

The variation in pesticides and fertilizers use by location is shown in **Table E-16**. Los Angeles N. Main residents apply pesticides and fertilizers five times more often than Pico Rivera residents. The time of day that pesticide and fertilizers are applied is also different. For example, Azusa respondents report 69% use in the morning compared to 0% by Pico Rivera respondents. Los Angeles N. Main and Pico Rivera respondents report 48% and 50% of their activity occur in the evening compared to Azusa respondents who report 8% activity in the evening.

Table E-16. Application of pesticides and fertilizers by location and by time of day.

MONITORING SITE	% OF RESIDENCES WITH THIS ACTIVITY DAILY	% MORNING	% AFTERNOON	% EVENING
Azusa	1.9%	69%	23%	8%
Industrial Hills	2.6%	47%	33%	20%
Los Angeles N. Main	5.1%	29%	24%	48%
Pico Rivera	1.0%	-	50%	50%

E-9. POURING DIESEL OR GASOLINE INTO OR OUT OF A CAN

As shown in **Table E-17**, the pouring of diesel or gasoline occurs more often on Thursday through Sunday (17%-21%) and least often on Monday through Wednesday (9%) and occurs more often in the morning (41%) and evening (41%) and much less often in the afternoon (11%).

Table E-17. Pouring diesel or gasoline into or out of a can by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	9%	50%	50%	-
T	9%	-	-	100%
W	9%	-	-	100%
Th	21%	40%	20%	40%
F	17%	78%	22%	-
S	19%	67%	11%	22%
S	17%	50%	25%	25%
-	Average	41%	18%	41%

As shown in **Table E-18**, Industrial Hills residents pour diesel or gasoline 60% more often than other sites. The time of day that this process occurs also varies. Pico Rivera residential respondents report this process occurring 100% in the morning compared to 17% by Los Angeles N. Main respondents. Los Angeles N. Main respondents report 83% of their activity occurs in the evening compared to Azusa and Pico Rivera respondents with no activity in the evening.

Table E-18. Pouring diesel or gasoline into or out of a can by zone by time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
Azusa	1.3%	60%	40%	-
Industrial Hills	2.6%	47%	27%	27%
Los Angeles N. Main	1.5%	17%	-	83%
Pico Rivera	1.6%	100%	-	-

E-10. MOTOR VEHICLES DRIVEN FROM RESIDENCE

As shown in **Table E-19**, motor vehicles are driven equally every day of the week. Motor vehicles are most often driven from residences in the morning (46%) followed by the afternoon (30%) and then the evening (24%).

Table E-19. Frequency of motor vehicles driven from residences by day of week and time of day.

DAY OF WEEK	% OF RESIDENCES BY DAY WITH THIS ACTIVITY	MORNING	AFTERNOON	EVENING
M	14%	50%	28%	22%
T	15%	48%	28%	23%
W	15%	48%	28%	24%
Th	14%	48%	27%	25%
F	15%	46%	31%	23%
S	14%	40%	35%	26%
S	13%	41%	35%	23%
-	Average	46%	30%	24%

E-11. WD-WE PEAK ACTIVITY TIMES

Table E-20 summarizes our finding as to the peak period(s) of each residential activity as reported in prior sections of this appendix. Both day of week (WD-WE) and time of day (morning, afternoon, and evening) that an activity was most engaged in by respondents is reported. Not surprisingly, Saturday appears as the most frequent day of activity. This was not unexpected as it is a day in which most adults are not working at a business. Morning is the time most mentioned as when an activity was most frequently engaged in.

Table E-20. Intercomparison of residential activity in terms of peak activity time.

ACTIVITY	DAY OF WEEK		TIME OF DAY	
	Peak Day	Peak Frequency	Peak Time	Peak Frequency
Barbecue	Sat, Su	23-25%	E	73%
Consumer products	None	-	M	70%
Engine oils	W, Sat	20-26%	M/A	36-41%
Fireplaces	W, Sat	20-23%	M	52%
Gasoline powered lawn equipment	F, Sat	20%	M/A	49-42%
Paints and solvents	None	-	M/A	40-47%
Paving materials	Th, Sat	19%	M	69%
Pesticides or fertilizers	F, Su	22%	M/E	37-42%
Pouring of diesel or gasoline	Th-Su	17-21%	M/E	41%
Vehicle traffic	None	-	N/A	N/A

M/A/E = Morning, Afternoon, Evening

E-12. UNCERTAINTY OF RESIDENTIAL RESPONSES

A strict approach was taken in determining whether a respondent took part in a particular activity each day. The approach taken was that the postcards received from respondents required a “yes” for an activity and the time of day (either morning, afternoon, and/or evening). There is a possibility that by taking this approach, this analysis understates the frequency of some residential activities. For example, the residential responses on postcards include those in which “yes” was checked for an activity but the time of day (morning, afternoon, evening) was not checked. Our approach assumes that the respondent inadvertently checked “yes” rather than “no” for the activity. To the extent the respondent correctly checked “yes” for the activity but forgot to indicate a time of day, this analysis undercounts the frequency of an activity by residence.

Postcards from Azusa respondents were most often found to show this unusual response of checking “yes” for an activity but not checking a time of day. The total number of such occurrences by activity was for a few activities higher than the number of Azusa respondents that checked “yes” for the activity and checked morning, afternoon, and/or evening for the time of occurrence. This means that for a few activities the percentage of residences engaged in that activity by day as reported for Azusa could be understated by as much as a factor of 2.

The residential survey data also includes postcards in which the respondent checked “no” for the activity but indicated a time of day (either morning, afternoon, or evening). To the extent the respondent incorrectly checked “no” and meant to check “yes”, this analysis also undercounts the frequency of this activity by residence.

During the period September 29 to October 8, 2000, survey period, it rained on Wednesday, October 4 and Friday, October 6. Because it rained on Wednesday and the second Friday, the possibility exists that the survey results as to residential activity are affected by this phenomenon.

Because the response for consumer products on Wednesday (a rain day) is similar to that reported on Tuesday and Thursday, and the outcome on the second Friday is between that on Thursday and Saturday, there is no reason to believe that weather (rain) affected the outcome of the survey for consumer products. (See **Figure E-1**)

With regard to barbecues, engine oils, paints and solvents, and pesticide and fertilizer usage, the findings are as follows. We note that the number of positive responses is rather small (less than 15 for any given day), and so marginal changes in activity from day to day may explain the variations observed (see **Figure E-2**).

As shown in **Figure E-3**, the number of positive responses reported by day for fireplace, pouring diesel or gasoline (D/G), and paving are so small (7 or less) that attempting to identify whether weather (rain) affected the outcome of the survey results for these activities is not possible.

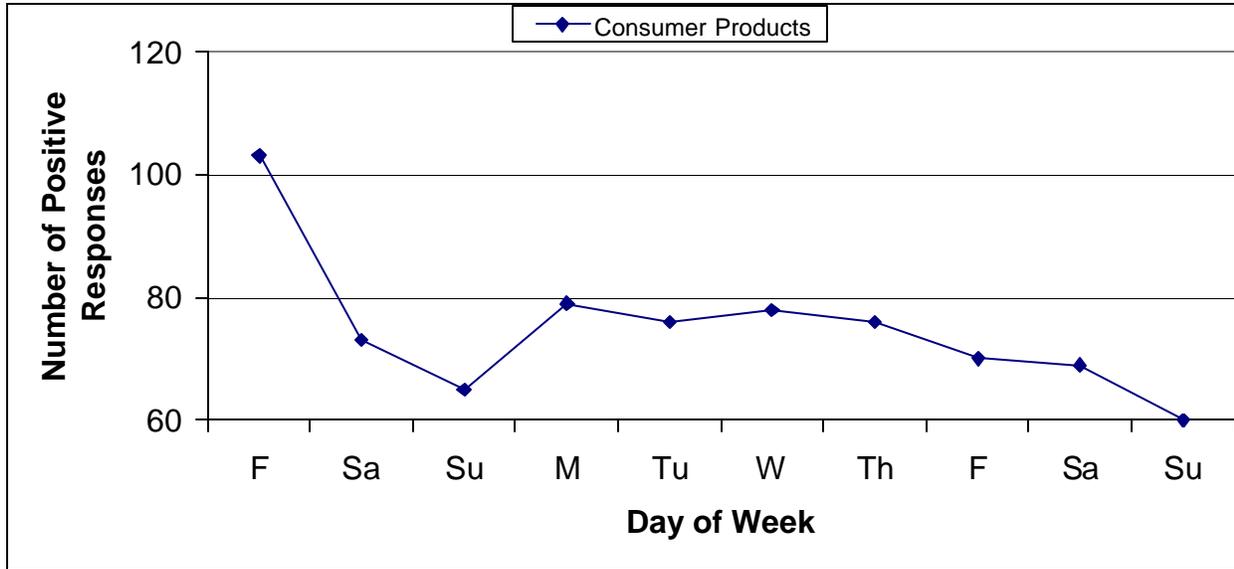


Figure E-1. Reported consumer product activity by day of week.

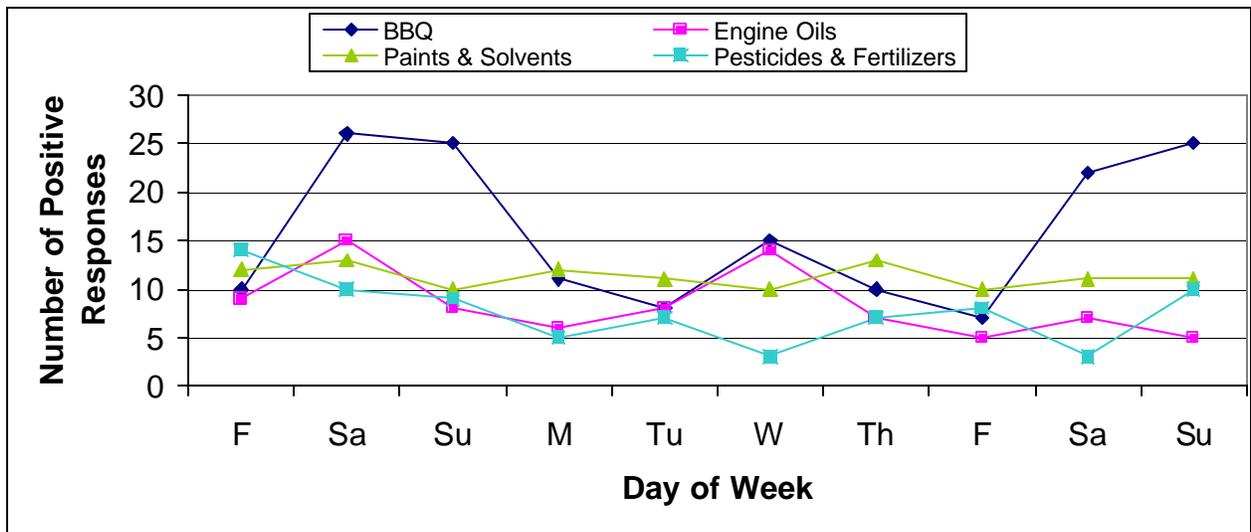


Figure E-2. Number of Respondents reported to be using the barbecue, engine oils, paints and solvents, and pesticides and fertilizers by day surveyed.

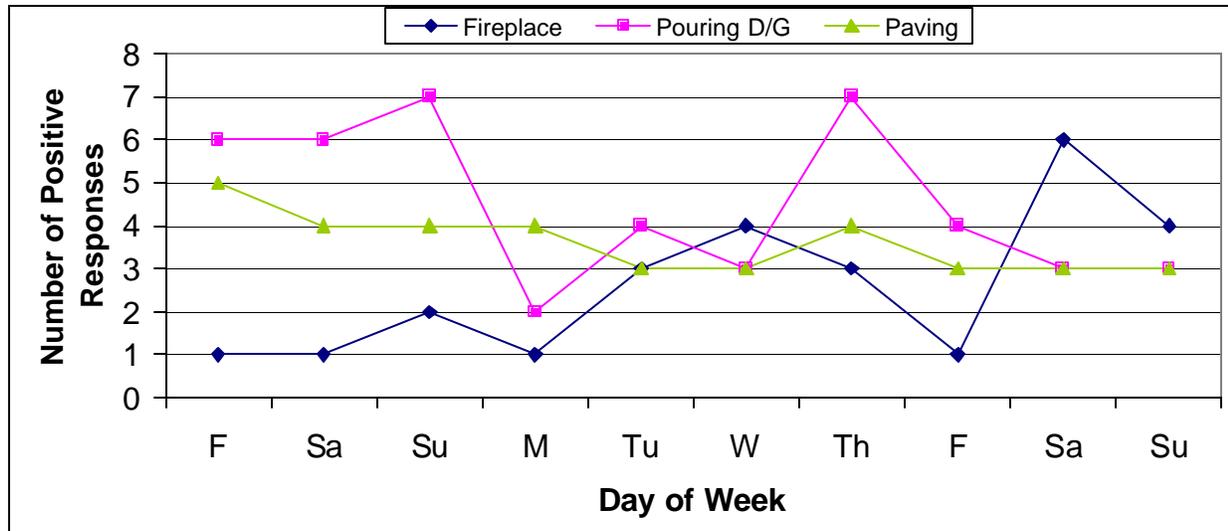


Figure E-3. Number of Respondents reported to be using fireplaces, paving, or pouring fuels.

Table E-21 provides an overall summary of respondents to the residential surveys.

The data show that

- Paving is an activity that 1% of respondents reported being involved with each day. This percentage seems unusually high, as it equates to every household having two or more days of paving activity a year (365-days). For comparison, a roof that needed attending to once every five years would equate to a daily rate of activity of 0.05%, or a rate of activity twenty times less often than that reported by the residences responding.
- While mechanics replace motor oils, gear oils or fluids, or brake fluids routinely, the 3% oil use percentage for households seems high as it equates to each household involved with engine oil 11 days a year. For comparison, a vehicle that underwent an oil change at a residence every ninety days would result in an activity rate of 1%, or 3 times less often than that reported by residences responding.
- The 4% paint usage rate also seems rather high, as it equates to every household applying paint 14 days a year, or roughly, one day a month.
- We also did not expect fireplaces to be used ten times more often in the morning (46%) than in the evening (4%).

On the other hand, we note that

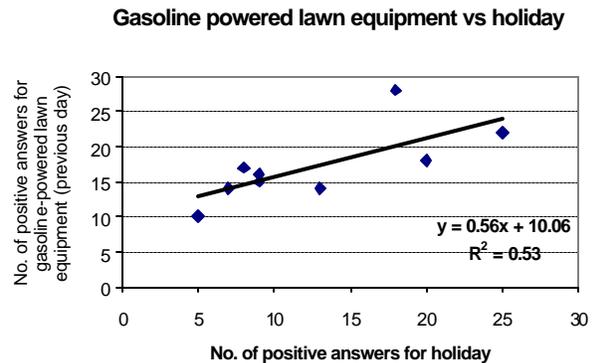
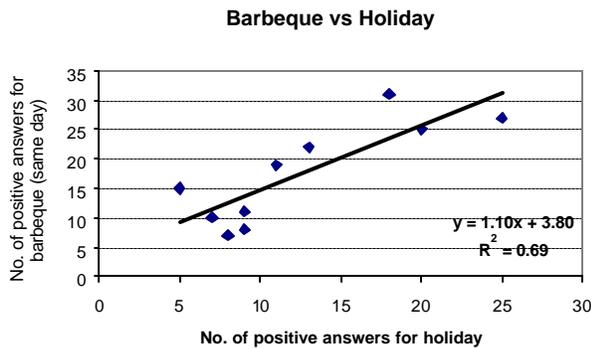
- The 7% usage rate of gasoline-powered yard equipment equates to every household operating lawn and garden equipment at a rate of once every two weeks. This rate of activity falls within what seems reasonable (i.e., mowing the lawn every other week).
- The 3% pesticide/fertilizer usage rate equates to an application rate of eleven days a year, or almost once a month. This rate of activity seems reasonable, as gardens/lawns are likely to be fertilized regularly.

Table E-21. Overall residential response by activity.

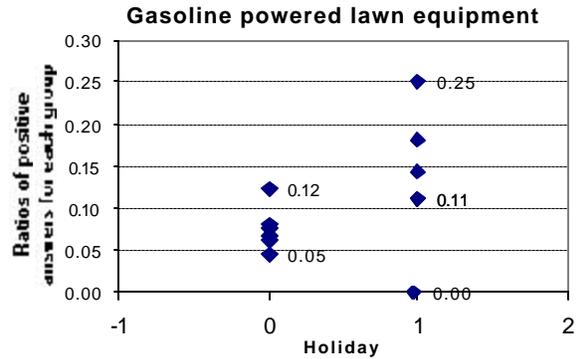
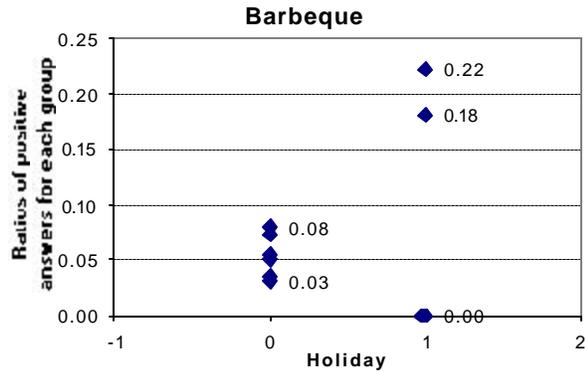
ACTIVITY	% OF AFFIRMATIVE RESPONSES	MORNING	AFTERNOON	EVENING
Barbecue	7%	6%	31%	63%
Consumer Products	32%	70%	14%	16%
Engine oils	3%	40%	40%	19%
Fireplace	1%	42%	21%	38%
Gasoline Powered Equipment	6%	46%	45%	9%
Paint	4%	37%	50%	13%
Paving	0.7%	60%	27%	13%
Pesticide/Fertilizer	3%	45%	24%	31%
Pouring oil/gas	2%	54%	19%	27%
Vehicles depart from household	89%	45%	31%	24%

Rain and Holidays

Holidays are positively correlated with lawn/garden equipment usage and barbecue usage. Rain is negatively correlated with barbecue usage. Otherwise, no clear patterns were apparent. With a high degree of confidence ($p \leq 0.05$), it was shown that barbecues are less likely to be used during rainy periods than not. Lawn/garden equipment were more likely to be used on holidays ($p = 0.065$). (For the study period, most of the “holiday” responses referred to weekend days.) No clear relationship between rain and lawn/garden equipment usage was observed. Weak correlations were shown for (a) barbecue usage rates vs. holiday response rates, as well as (b) lawn/garden equipment usage for days preceding holidays.



When weekday holidays were considered alone, the number of responses for the weekday-only holiday group makes firm conclusions difficult. However, relationships seem to persist. The ratios of positive responses to total responses were calculated for each group (holiday=1 vs. non-holiday=0) and each weekday (M-F). The ratios for Group 1 tend to be higher than those for Group 0.



No clear patterns emerged for fireplace usage vs. holidays or vs. rain.

APPENDIX F

RESULTS OF BUSINESS ACTIVITY SURVEYS

The purpose of this appendix is to characterize and describe business responses in the areas surrounding four monitoring locations in greater detail. Emissions from area sources are commonly based on a surrogate measure such as the number of employees at businesses engaged in the activity of interest. For this reason, the following presentation reports survey results from businesses as to the number of employees working by day of week and hour of day.

The business density in each of the four locations surveyed varied significantly. As a result, businesses contacted were distributed as follows. About 20% of the respondents were near Azusa, 5% of the businesses were located in Industrial Hills, 68% in near Los Angeles N. Main, and 7% in Pico Rivera.

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F-1. RESULTS OF BUSINESS ACTIVITY SURVEYS

As shown in **Table F-1**, the largest single emissions-related activity engaged in by small businesses in this survey was the use of solvents (14% of those surveyed engaged in this activity). Next in order of occurrence was engine oil usage and internal combustion engine operation at 9%, and then gas ovens at 6%. None of the businesses surveyed reported being actively involved with pesticides or fertilizers.

Table F-1. Emissions-related business activity.

ACTIVITY	% OF BUSINESSES SURVEYED INVOLVED IN THIS ACTIVITY
Engine Oils	9%
Gas Ovens	6%
IC Engines	9%
Pesticides/Fertilizers	0%
Solvents	14%
Any of the above	20%

Table F-2 shows the percentage of workers employed at surveyed businesses overall and by activity of interest by day of week (WD, Saturday, Sunday). Worker hours decline by activity on Saturdays by factors of 2 to 5 relative to weekdays and on Sunday by factors of 4.5 to 19 relative to weekdays. All respondents, regardless of activity type, had nearly identical WD-WE activity profiles, except those for gas ovens which were twice as active on Saturday as any other activity.

The survey also asked businesses the number of employees who were at work in six time periods representing the following 4-hour shifts: midnight to 4 a.m., 4 a.m. to 8 a.m., 8 a.m. to noon, noon to 4 p.m., 4 p.m. to 8 p.m., and 8 p.m. to midnight.

Table F-2. Business activity in terms of percentage of workers employed by day of week.

BUSINESS ACTIVITY	WEEKDAY (MONDAY-FRIDAY)	SATURDAY	SUNDAY
All Survey Respondents	18%	5%	4%
Use of Engine Oils	18%	5%	4%
Use of Gas Ovens	18%	9%	3%
Operation of Internal Combustion Engines	18%	5%	4%
Use of Solvents	19%	4%	1%

Table F-3 lists the percentage of workers employed by 4-hour shift of the day based on all survey respondents and by activities. While all respondents and those with specific activities show a maximum number of hours worked occurring in the day shift (8 a.m. to 4 p.m.), the percentage of hours worked in other shifts differ greatly depending upon the activity.

Businesses using engine oils and those operating internal combustion engines reported identical levels of activity. For clarity, only internal combustion engine activity response is shown below. Businesses operating internal combustion engines have by far the greatest percentage of workers employed from 4 a.m. to 8 a.m. From 4 a.m. to 8 a.m. these businesses employ 23% of their work force and thus 23% of their emissions for the day occur in this early morning time frame. This is more than twice the 9% activity rate for all businesses. The work force at businesses using solvents is about twice that of all businesses from midnight to 8 a.m. At businesses using gas ovens, the work force operates in three distinct shifts. 6% of the work force is employed from midnight to 8 a.m., 55% from 8 a.m. to 4 p.m., and 39% from 4 p.m. to midnight. Note that the 3% of the work force employed from 4 a.m. to 8 a.m. equals one-third of the 9% reported by all businesses. The 19% of the work force employed from 8 p.m. to midnight is double the 9% average employed by all businesses. Thus, businesses using gas ovens show lower early morning and higher evening worker activity relative to the average of all businesses surveyed.

Table F-3. Weekday business activity as a percentage of work force employed by time of day.

CATEGORY	MIDNIGHT – 4 A.M.	4 A.M. – 8 A.M.	8 A.M. – NOON	NOON – 4 P.M.	4 P.M. – 8 P.M.	8 P.M. - MIDNIGHT
All Survey Respondents	3%	9%	32%	32%	15%	9%
Use of Engine Oils	3%	23%	33%	28%	9%	4%
Use of Gas Ovens	3%	3%	27%	28%	20%	19%
Operation of Internal Combustion Engines	3%	23%	33%	28%	9%	4%
Use of Solvents	6%	14%	28%	28%	13%	11%

Table F-4 presents the percentage of workers employed on Saturday by 4-hour shift of the day based on all survey respondents and by businesses with select activities. The lowest level of employment is from midnight to 4 a.m. and the highest level of worker employment occurred from 8 a.m. to noon. This is true of all survey respondents and for businesses with emission-related activities. Worker activity at businesses with specific activities are factors of 2 to 5 higher from midnight to 8 a.m. and as much as a factor of two lower from 4 p.m. to midnight than at all businesses surveyed on Saturday.

At businesses using solvents, 5% of the work force is employed from midnight to 4 a.m. and 7% from 4 a.m. to 8 a.m. These activity levels are about twice the 2% and 4% levels reported by all businesses during the same time periods. At businesses using solvents, 9% of the work force is employed from 4 p.m. to 8 p.m. and 6% from 8 p.m. to midnight. These activity levels are about half the 19% and 14% levels reported by all businesses during the same time period.

Table F-4. Saturday business activity as a percentage of work force employed by time of day.

CATEGORY	MIDNIGHT – 4 A.M.	4 A.M. – 8 A.M.	8 A.M. – NOON	NOON – 4 P.M.	4 P.M. – 8 P.M.	8 P.M. - MIDNIGHT
All Survey Respondents	2%	4%	33%	29%	19%	14%
Use of Engine Oils	11%	14%	26%	21%	15%	12%
Use of Gas Ovens	6%	6%	35%	34%	11%	9%
Operation of Internal Combustion Engines	11%	14%	26%	21%	15%	12%
Use of Solvents	5%	7%	41%	32%	9%	6%

Businesses using engine oils and those operating internal combustion engines are found to have identical levels of worker activity by hour of day. From midnight to 8 a.m., these businesses employed 25% of their work force, which is roughly equivalent to the 27% employed from 4 p.m. to midnight. At businesses using gas ovens 6% of the work force is employed from midnight to 8 a.m. This is the lowest level of activity at businesses using gas ovens. From 4 p.m. to 8 p.m., businesses using gas ovens employ 11% of their employees.

In summary, we have found that on Saturday, businesses with emission-related activities have employment patterns different from other businesses. Those businesses with emission-related activities have higher employment in the early morning from midnight to 8 a.m. than that of all survey respondents. Conversely, businesses with emission-related activities have lower employment in the evening from 8 p.m. to midnight than would be estimated from the pattern of employment reported by all survey respondents.

Table F-5 lists the percentage of workers employed on Sunday by 4-hour shift based on all survey respondents and by businesses with select activities. At businesses using solvents, 12% of the work force for the day is employed from midnight to 4 a.m. and 16% from 4 a.m. to 8 a.m. These activity levels are about five times the 2% and 3% levels reported by all businesses during the same time periods. At businesses using solvents, 19% of the work force is employed from 4 p.m. to 8 p.m. and 16% from 8 p.m. to midnight. These activity levels are about 25% lower than the 24% and 19% levels reported by all businesses during the same time period.

Table F-5. Sunday business activity as a percentage of work force employed by time of day.

CATEGORY	MIDNIGHT – 4 A.M.	4 A.M. – 8 A.M.	8 A.M. – NOON	NOON – 4 P.M.	4 P.M. – 8 P.M.	8 P.M. - MIDNIGHT
All Survey Respondents	2%	3%	26%	26%	24%	19%
Use of Engine Oils	13%	17%	17%	17%	19%	16%
Use of Gas Ovens	12%	13%	21%	20%	18%	16%
Operation of Internal Combustion Engines	13%	17%	17%	17%	19%	16%
Use of Solvents	12%	16%	18%	19%	19%	16%

Businesses using engine oils and operating internal combustion engines are found to have roughly identical levels of worker activity by hour of day. From midnight to 4 a.m. and 4 a.m. to 8 a.m., these businesses employed 13% and 17% of their work force for the day. This is more than six times the 2% and 3% employment percentages from all businesses surveyed.

At businesses using gas ovens, 12-13% of the work force is employed from midnight to 8 a.m., which is about six times the 2% and 3% employed by all businesses from midnight to 4 a.m. and 4 a.m. to 8 a.m. From 4 p.m. to 8 p.m., businesses using gas ovens employ 16-18% of their work force for the day, which is substantially lower than the 19-24% employed by all businesses.

F-2. UNCERTAINTY DISCUSSION

The number of businesses sampled was relatively small. As a result, the number of business respondents who were engaged in any particular emission-related activity was also small. For example, only eight businesses reported the use of gas ovens. If the business with the largest number of workers using gas ovens had not been selected as part of the survey, we would have obtained a percentage of 16% on weekdays and 11% on both Saturday and Sunday of workers employed by day of week. As shown in **Table F-6**, the weekday percentage of 16% is about 10% lower than the 18% estimate based on all survey respondents using gas ovens. The Saturday percentage of 11% is 22% higher than the 9% based on all survey respondents using gas ovens. The Sunday percentage of 11% is more than three times higher than the 3% based on all survey respondents using gas ovens. The 10% change for weekdays (Monday through Friday), 22% change for Saturday, and factor of three change on Sunday provides evidence of the level of uncertainty associated with small sample sizes.

Table F-6. Business activity as a percentage of workers employed by day of week.

BUSINESS ACTIVITY (EXCEPT AS NOTED)	WEEKDAY (MONDAY-FRIDAY)	SATURDAY	SUNDAY
Use of Gas Ovens	18%	9%	3%
Use of Gas Ovens (excluding the survey results from one business)	16%	11%	11%

APPENDIX G

DEVELOPMENT OF TEMPORAL ACTIVITY PROFILES

Temporal adjustments are used to modify emission estimates to reflect the time period of interest. Adjustments may need to be made to reflect differences in the usage level for a season, a certain day of the week, or time of day. Day-of-week and time-of-day adjustment factors based on the study results are presented in this Appendix.

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G-1. WD-WE TEMPORAL ADJUSTMENT FACTORS

The EPA methodology for estimating emissions for a specific day relative to an average day is as follows:

$$\text{Emission}_{\text{Day}} = \text{Emissions}_{\text{AveDay}} * (\text{Weight Factor}_{\text{Day}} / \text{Weight Factor}_{\text{Total}}) / 7 \quad \text{(G-1)}$$

Based on this EPA equation, the WD-WE factors (weight factor) to apply for the sources surveyed in this study are shown in **Table G-1**. Note EPA recommends the totals sum to 1000.

Table G-1. Weekly profile of business, residential, mobile, and point source temporal adjustment factors.

SOURCE CATEGORY	DESCRIPTION	MON-TH	FRI	SAT	SUN	TOTAL
Business	Engine Oils	182	182	50	40	1000
Business	Gas Ovens	176	176	88	29	997
Business	IC Engines	182	182	50	40	1000
Business	L&G Equipment ^a	188	188	41	20	1001
Business	Solvents	190	190	40	10	1000
Residential	Barbeques	105	100	250	230	1000
Residential	Consumer Products	144	168	139	119	1002
Residential	Engine Oils	148	99	198	109	998
Residential	Fireplace	132	70	230	170	998
Residential	L&G Equipment*	120	204	204	112	1000
Residential	Paints & Solvents	145	130	160	130	1000
Residential	Paving	144	99	188	139	1002
Residential	Pesticides & Fertilizer	100	220	160	220	1000
Residential	Pouring D/G ^b	119	168	188	168	1000
Mobile	Passenger	150	150	130	120	1000
Mobile	MD Trucks	170	180	80	60	1000
Mobile	HD Trucks	180	150	70	50	990
Mobile	Bus	170	150	100	70	1000
Point	Point	152	141	126	124	999

^a L&G – Lawn and Garden

^b D/G – Diesel or Gasoline from a can

G-2. DIURNAL PROFILE ADJUSTMENT FACTORS

The EPA methodology for estimating emissions for a specific hour relative to an average day is as follows:

$$\text{Emission}_{\text{Hr}} = \text{Emissions}_{\text{Day}} * (\text{Weight Factor}_{\text{Hr}} / \text{Weight Factor}_{\text{Total}}) \quad (\text{G-2})$$

Based on this EPA equation, the diurnal factors (weight factor) to apply for business sources of interest appear in **Table G-2**, for the residential sources of interest in **Table G-3**, and for on-road motor vehicles in **Table G-4**. Note EPA recommends that totals sum to 10,000. These diurnal profiles are based solely on the activity levels resulting from the surveys of this study.

Table G-2. Diurnal profile for businesses activities.

SOURCE CATEGORY	DESCRIPTION	WD-WE	1,2,3,4,	5,6,7,8	9,10,11,12	13,14,15,16	17,18,19,20	21,22,23,24	TOTAL
Business	Engine Oils	M-F	75	575	825	700	225	100	10,000
		Sat	275	350	650	525	375	300	9,900
		Sun	325	425	425	425	475	400	9,900
Business	Gas Ovens	M-F	75	75	675	700	500	475	10,000
		Sat	150	150	875	850	275	225	10,000
		Sun	300	325	525	500	450	400	10,000
Business	IC Engines	M-F	75	575	825	700	225	100	10,000
		Sat	275	350	650	525	375	300	9,900
		Sun	325	425	425	425	475	400	9,900
Business	Lawn & Garden Equipment	M-F	27	622	901	834	89	27	10,000
		Sat	24	536	1079	818	35	8	10,000
		Sun	4	889	905	640	54	8	10,000
Business	Solvents	M-F	150	350	700	700	325	275	10,000
		Sat	125	175	1025	800	225	150	10,000
		Sun	300	400	450	475	475	400	10,000

As a convention, hour 1 refers to the first hour of the day (midnight to 1 a.m.) local time, hour 2 refers to the second hour of the day (1 a.m. to 2 a.m.), etc.

Table G-3. Diurnal profile for residences.

SOURCE CATEGORY	DESCRIPTION	WD-WE	5,6,7,8,9, 10,11,12	13,14,15, 16,17	18,19, 20,21	TOTAL
Residential	Barbecues	M-Th	119	195	2019	10,003
		F	0	240	2200	10,000
		Sat	88	780	1350	10,004
		Sun	88	960	1125	10,004
Residential	Consumer Products	M-Th	900	250	388	10,002
		F	825	300	475	10,000
		Sat	850	360	375	10,100
		Sun	888	300	350	10,040
Residential	Engine Oils	M-Th	391	830	675	9,978
		F	500	800	500	10,000
		Sat	625	780	275	10,000
		Sun	413	880	550	9,904
Residential	Fireplace	M-Th	728	415	519	9,975
		F	838	660	0	10,004
		Sat	312	260	1,575	10,096
		Sun	500	400	1,000	10,000
Residential	Lawn & Garden Equipment	M-Th	659	825	156	10,021
		F	500	1,140	75	10,000
		Sat	550	820	375	10,000
		Sun	625	660	425	10,000
Residential	Paints & Solvents	M-Th	572	850	300	10,026
		F	400	940	525	10,000
		Sat	375	1,140	325	10,000
		Sun	450	1,180	125	10,000
Residential	Paving	M-Th	938	250	312	10,002
		F	1250	0	0	10,000
		Sat	625	500	625	10,000
		Sun	412	1340	0	9,996
Residential	Pesticides & Fertilizer	M-Th	354	365	1331	9,981
		F	500	260	1175	10,000
		Sat	563	360	900	9,904
		Sun	750	800	0	10,000
Residential	Pouring Diesel or Gasoline from a can	M-Th	281	350	1500	9,998
		F	975	440	0	10,000
		Sat	838	220	550	10,004
		Sun	625	500	625	10,000

Table G-4. Diurnal profile for on-road motor vehicles.

HOUR	M-TH	F	SAT	SUN
1	107	96	139	154
2	70	91	91	114
3	52	67	85	92
4	58	53	70	82
5	91	79	72	83
6	173	179	142	145
7	328	334	257	272
8	493	462	348	385
9	543	491	419	413
10	488	424	554	462
11	477	430	657	534
12	481	476	653	538
13	492	502	586	576
14	547	557	551	638
15	621	651	625	655
16	649	703	688	702
17	688	766	734	787
18	750	796	776	768
19	742	710	711	684
20	669	625	549	602
21	571	535	450	513
22	450	423	367	404
23	287	311	281	267
24	178	224	200	143