Weekday/Weekend Activity Patterns for Residential and Small Commercial Area Sources in Los Angeles

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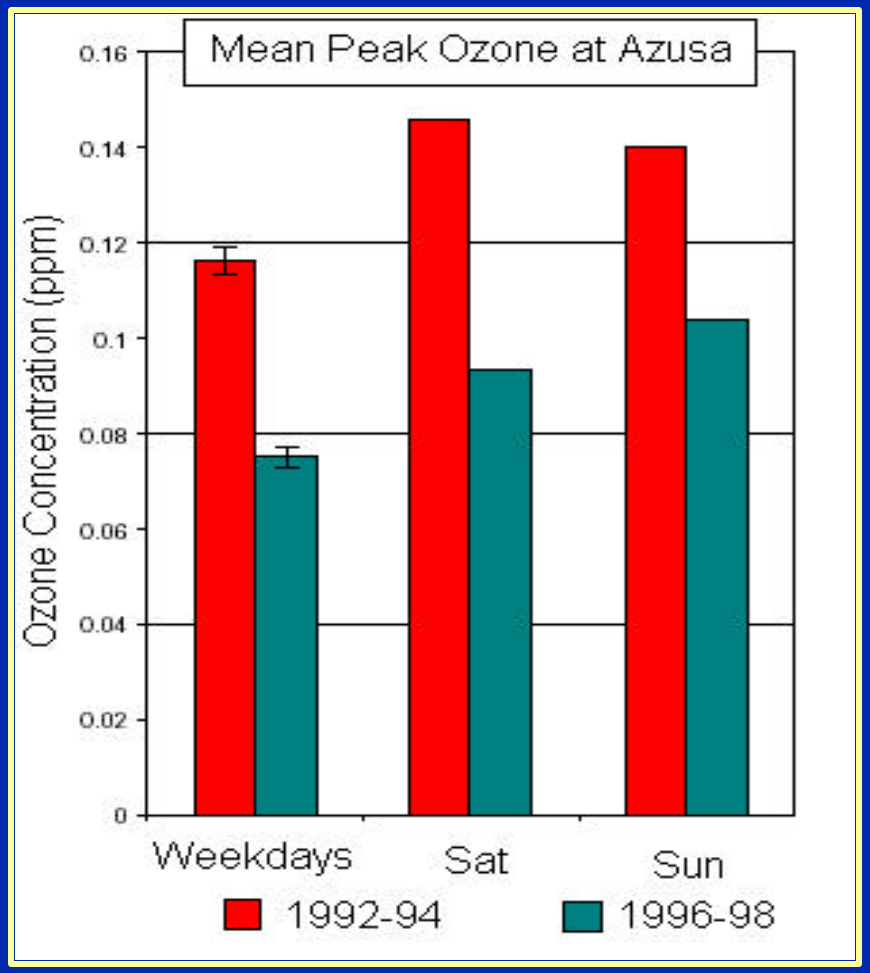
Weekend Effect in Los Angeles

Los Angeles ozone air quality improved from 1980 to 1999.

- No. of 1-hr exceedances decreased from about 150 to only 50 per yr.

Weekend (WE) peaks weekday (WD) peaks.

- From 1980-99, WD-WE difference became more pronounced.
- If WE precursor emissions are lower (we think), how can this be?



Source of figure: Austin, J.; Tran, H. "A Characterization of the Weekend-Weekday Behavior of Ambient Ozone Concentrations in California"; Draft staff report prepared by the Technical Support and Planning Division, California Air Resources Board, Sacramento, CA. 1999.

Purpose & Objectives

Purpose: Address a lack of WE-specific emissions data, which are needed to support air quality modeling exercises for WE conditions in Los Angeles.

Objectives:

Characterize WD-WE activity patterns for certain types of area sources in Los Angeles.

Coordinate with concurrent data collection efforts:

- Enhanced air quality monitoring at fixed locations
- Air quality monitoring from a vehicle-mounted mobile platform
- Monitoring of traffic volumes on surface streets
- Acquisition of freeway-based traffic volumes
- Acquisition of continuous emissions monitoring systems (CEMS) data for major stationary point sources

Summary of Findings

Some residential activities (RAs) in Los Angeles increase from WD to WE by 40% to 140% (e.g., BBQs, lawn/garden equipment).

Other RAs vary little by day of week (DOW) (e.g., personal care products).

Diurnal distributions of some RAs vary by DOW.

- On WDs, BBQ use occurs primarily in the evening, but on WEs the afternoon share of use increases significantly.

Summary of Findings

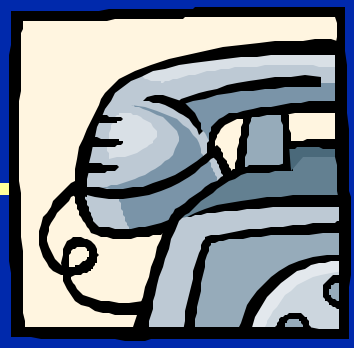
Business activities (BAs) in L.A. decline from WD to WE by 45% to 95% (e.g., lawn/garden services).

Most BAs peak 8 a.m. to 4 p.m. on WDs and Sat, but are flat on Sun.

- Exceptions are lawn/garden services, and use of gas ovens.

WD-WE decreases in BAs sometimes offset increases in RAs (e.g., use of lawn/garden equipment).

Approach



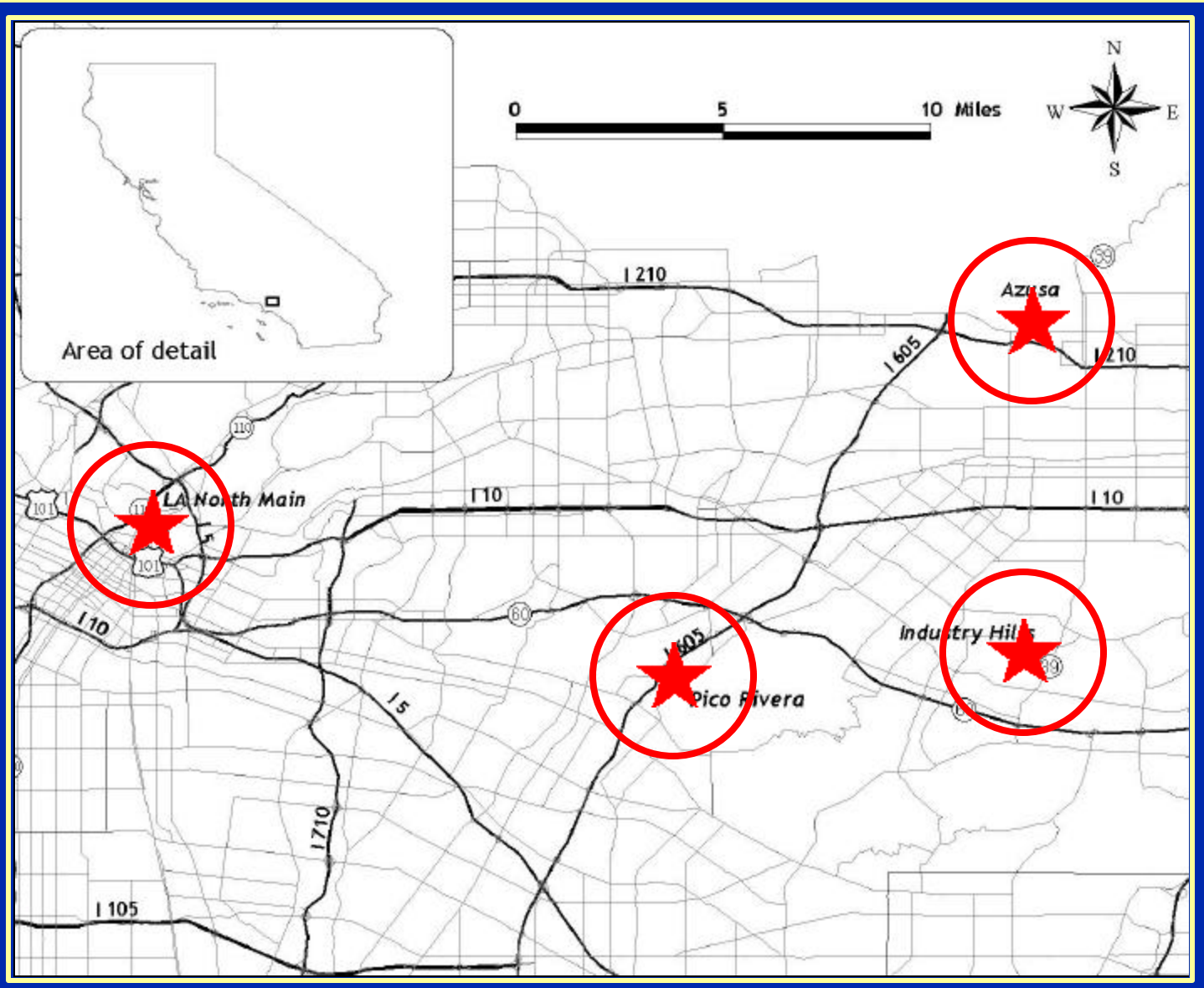
What? Telephone and mail surveys

Who? Residences and small businesses

When? September 29-October 8, 2000, plus separate study of lawn/garden maintenance businesses from September 6-25, 2001

Where? Four neighborhoods of Los Angeles (L.A.) were selected to coordinate with concurrent WD-WE air quality measurements. The commercial lawn/garden study was distributed across L.A. County.

Selected Neighborhoods



Results: Residential Activities

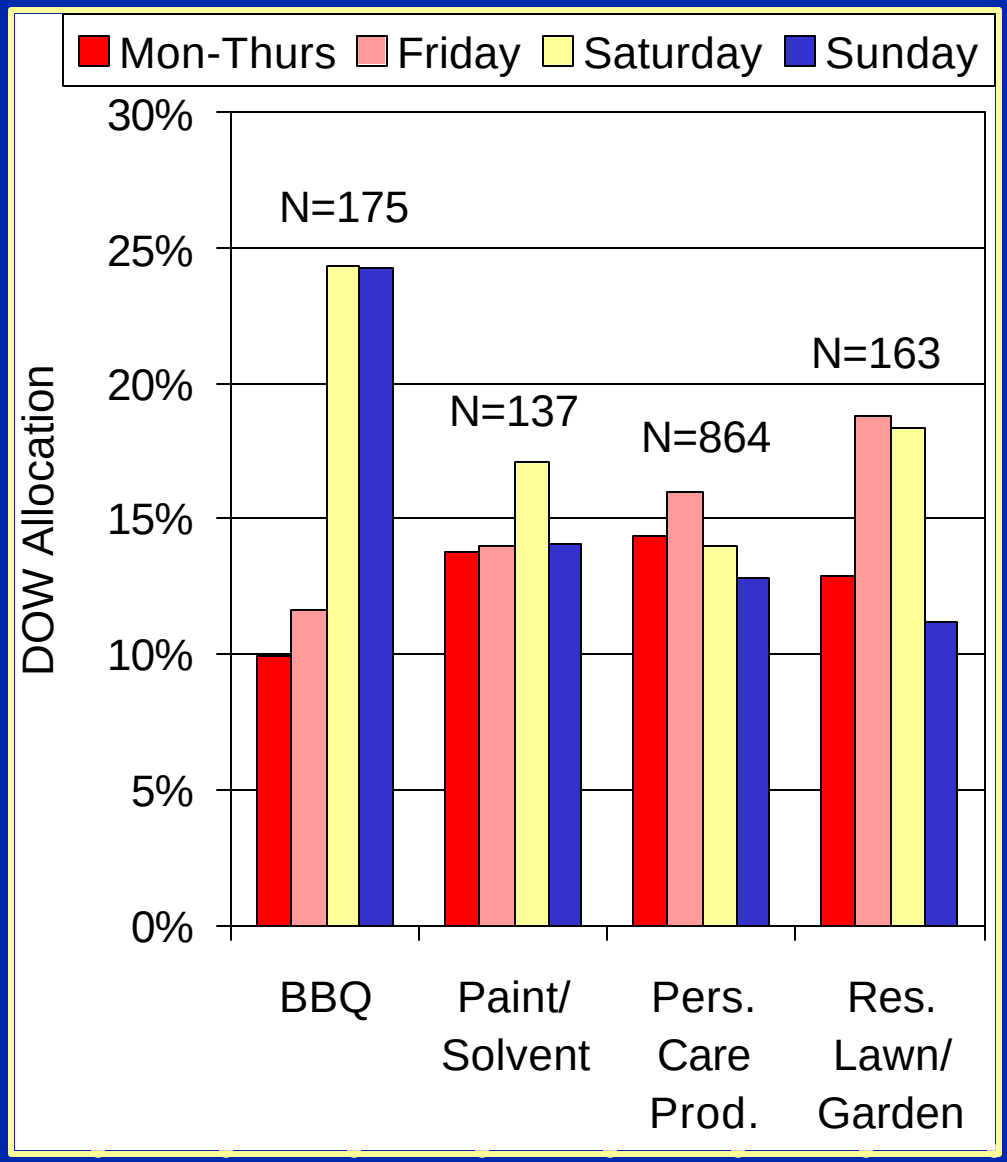
Some RAs increased from WDs to Fri/WEs by 40% to 140%, including uses of:

- barbecues*
- fireplaces
- fuel cans
- motor oils
- lawn/garden equipment*
- garden chemicals

Some RAs varied <25% by DOW, including uses of:

- paints/solvents*
- personal care products*
- paving/roofing materials

*see plot



Results: Residential Activities

Some RAs occurred at certain times of day:

- Evening: WD BBQ use*
- Afternoon:
  - paints/solvents
  - lawn/garden
- Morning: personal care products*

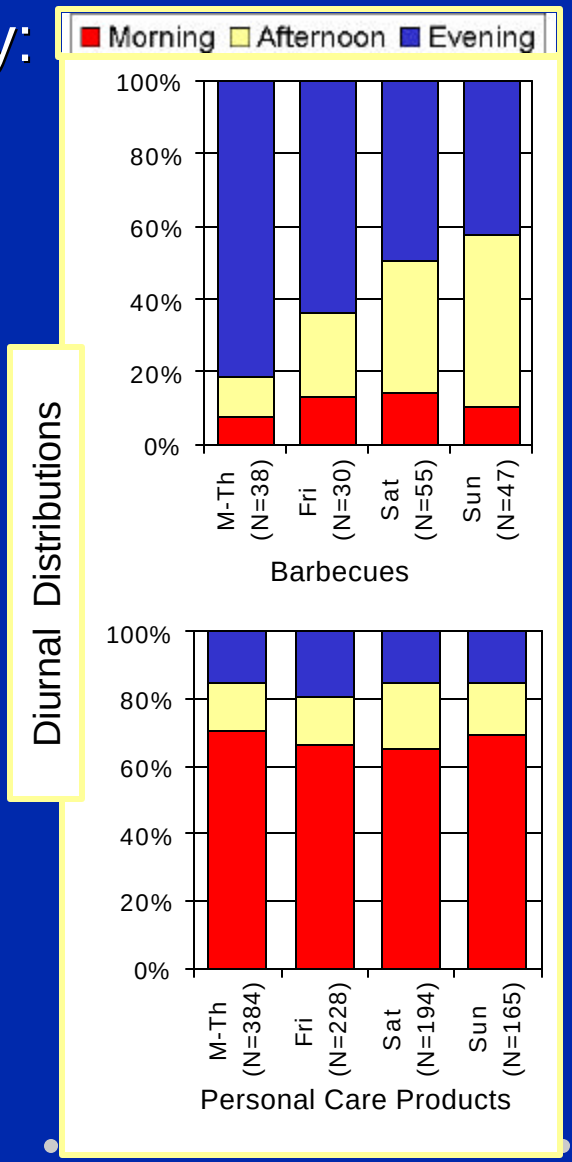
Some RAs had DOW-dependent patterns.

- WD BBQ use*: 11% of total in afternoon; 60% to 80% in evening
- WE BBQ use*: 35%-50% of total in afternoon; 40% to 50% in evening

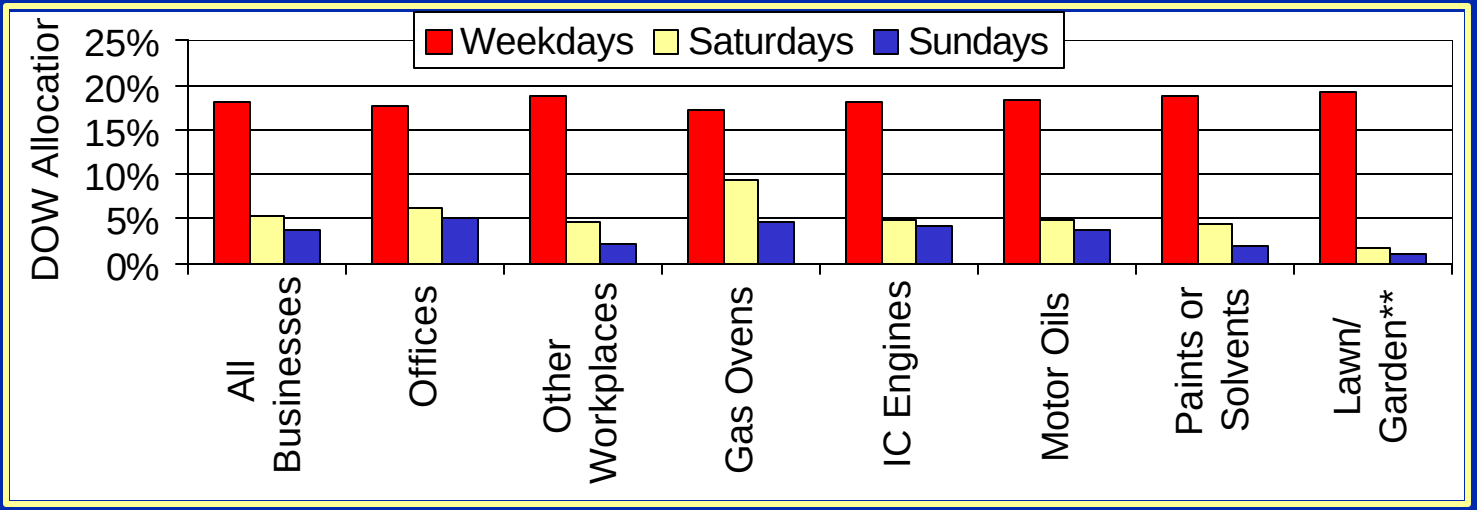
Some RAs had DOW-independent patterns.

- personal care products*
- lawn/garden

*see plot



Results: Business Activities



Business Type	WD-to-Sat % Reduced	WD-to-Sun % Reduced
All Businesses (Aggregate)	70%	79%
Gas Ovens	45%	70%
Lawn/Garden	92%	95%

Results: Business Activities

Aggregate:

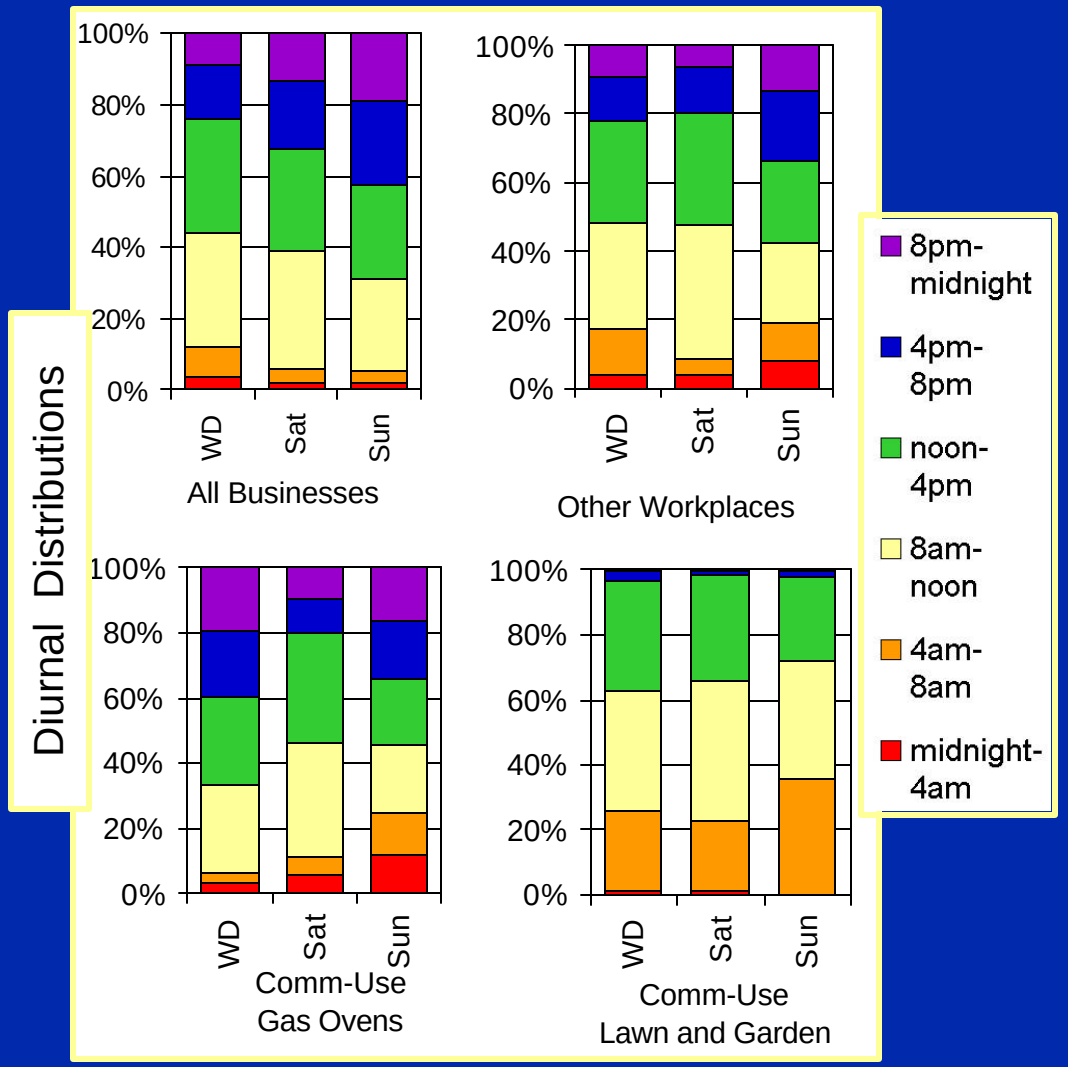
- On WD/Sat, BA peaks 8 a.m.-4 p.m.
- On Sun, distribution is more even 8 a.m.-12 a.m.

BA with gas ovens:

- Peaks late 12-4 p.m. WDs; sustains activity at 70% of peak 8 p.m.-12 a.m.

Lawn/garden service:

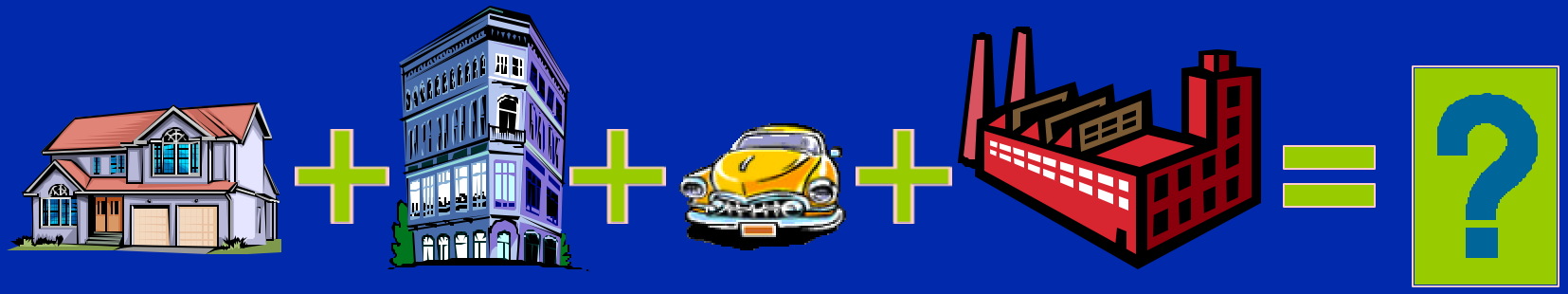
- Peaks early; reaches 70% of peak 4-8 a.m.; drops off fast after 4 p.m.
- DOW independent



Integration & Implications

We combined our RA and BA survey results with our findings from concurrent studies of on-road mobile and point sources.

We applied our integrated findings to the California Air Resources Board's emission inventories of NO_x and ROG for the South Coast Air Basin.

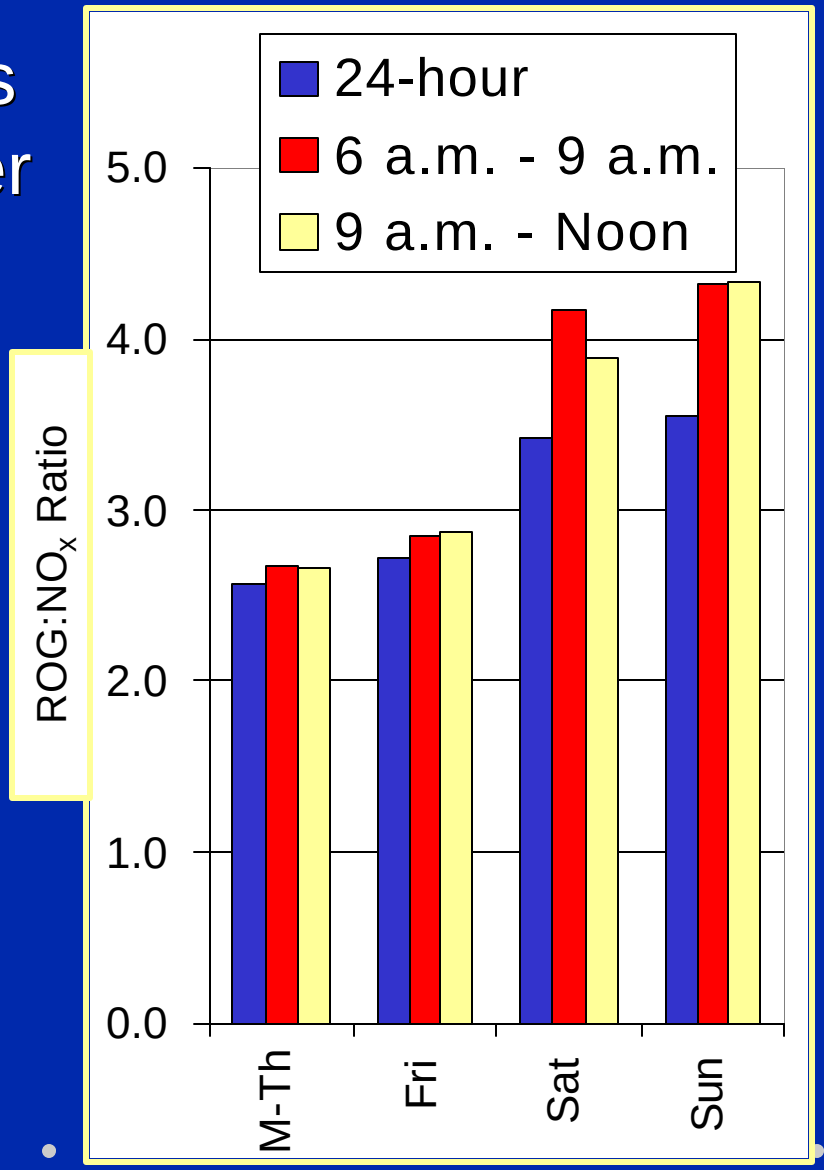


Integration & Implications

WE NO_x emission reductions are disproportionately greater than WE ROG reductions, especially before noon.

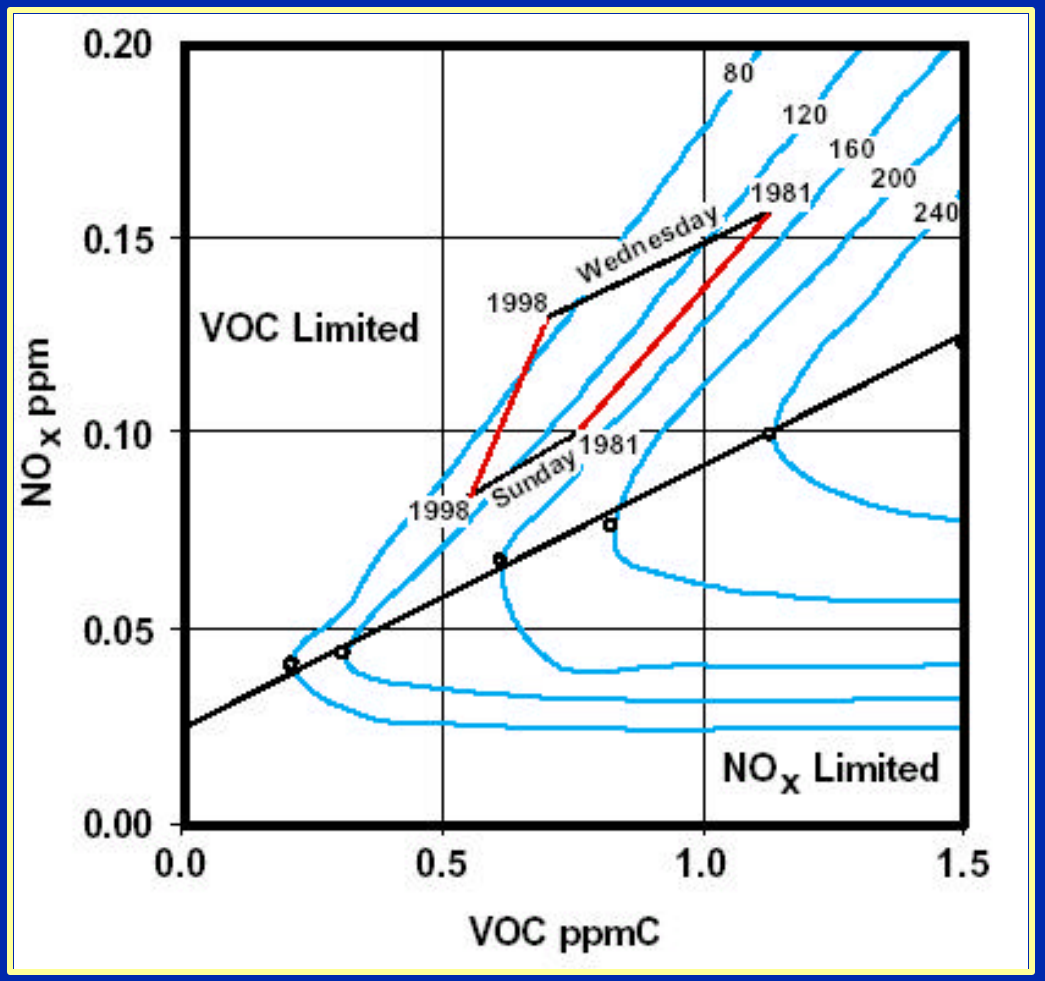
What effects would be expected?

- Increased ROG:NO_x ratio
- Decreased morning O_3 titration capacity by NO_x



Integration & Implications

WE conditions are more favorable for O_3 formation than WD conditions.



Source of figure: Fujita, E.M., et al. "Weekend/Weekday Ozone Observations in the South Coast Air Basin: Retrospective Analysis of Ambient and Emissions Data And Refinement of Hypotheses, Volume I – Executive Summary"; Final report prepared for the National Renewable Energy Laboratory, December 2000.

Limitations

Time period:

- September and October of 2000 and 2001
- May not be representative of summer ozone season

Geographic coverage:

- Four specific neighborhoods of L.A.
- May not be representative of all L.A.

BA sample sizes were small sample when segregated by equipment type in use.

- For example, only 8 businesses used gas ovens.

Therefore, conclusions are preliminary and serve as a guide for further research.

Future Research

ARB plans 2 new studies for summer 2002 with the following objectives:

- Expand the geographic area to the entire L.A. air basin.
- Perform the study during the summer ozone season.
- Target additional important source categories (e.g., construction) and infrequent activities (e.g., fireplaces).
- Partially repeat this study, but during the summer.

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