

Near-field NO₂ Impacts due to PM Traps for Diesel Engines

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California Environmental Protection Agency



Presentation Format

- Summary of Near Field NO₂ Results
- Details of Near Field Analysis (if desired)
 - Idling School Buses
 - High Volume Freeway

NO₂ Ambient Air Quality Standards

Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards ¹		Federal Standards ²		
		Concentration ³	Method ⁴	Primary ^{3,5}	Secondary ^{3,6}	Method ⁷
Nitrogen Dioxide (NO ₂)	Annual Arithmetic Mean	—	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m ³)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 µg/m ³)		—		



NO_x Emission Source Configurations

- Scenarios
 - Idling School Buses (20 buses)
 - High Volume Freeway (26,312 trucks/day)
- Consistent with...

Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles, Air Resources Board, 2000



Refined Model Assumptions for NO_x Exhaust Emissions

- PM Traps: **No**
 - 10% NO₂/NO_x
- PM Traps: **Yes**
 - 40% NO₂/NO_x
 - 90% Penetration
- 2010 Fleet
- Ozone Limiting Method
 - Hourly Ambient Data to Estimate NO₂ from NO_x



1-Hour NO₂ Results

Scenario	Traps: No	Traps: Yes
School Bus	120 ppb	170 ppb
Freeway	150 ppb	180 ppb
a) California 1-Hour NO ₂ standard is 250 ppb. b) Ambient NO ₂ is included.		
Note: A previous analysis included an idling truck scenario. The idling truck scenario is not consistent with the DRRP and a refined analysis was not completed; and therefore it is not included in this table.		



Annual NO₂ Results

Scenario	Traps: No	Traps: Yes
School Bus	5 ppb	5 ppb
Freeway	18 ppb	18 ppb

a) Federal Annual NO₂ standard is 53 ppb.
b) Screening estimates above are above ambient conditions only. Background NO₂ should be considered.
c) Refined analysis for annual NO₂ not completed because screening results are low relative to ambient standard.



End of Summary

Details of the analysis are available in the following 20 slides if desired.



Idling School Buses Details

Idling School Buses

- 20 buses queued 5 at a time
- Five minute idle time
- Idle at 8 am and 2 pm
- NOx emissions (EMFAC2002 V2.2)
 - Idle: 80.7 g/hr
 - Running 17.9 g/mile at 5 mph for 60 m
- Hourly Ambient Data and Met. Data
 - 2002 Los Angeles North Main
- ISCST3 Model with Rural Dispersion



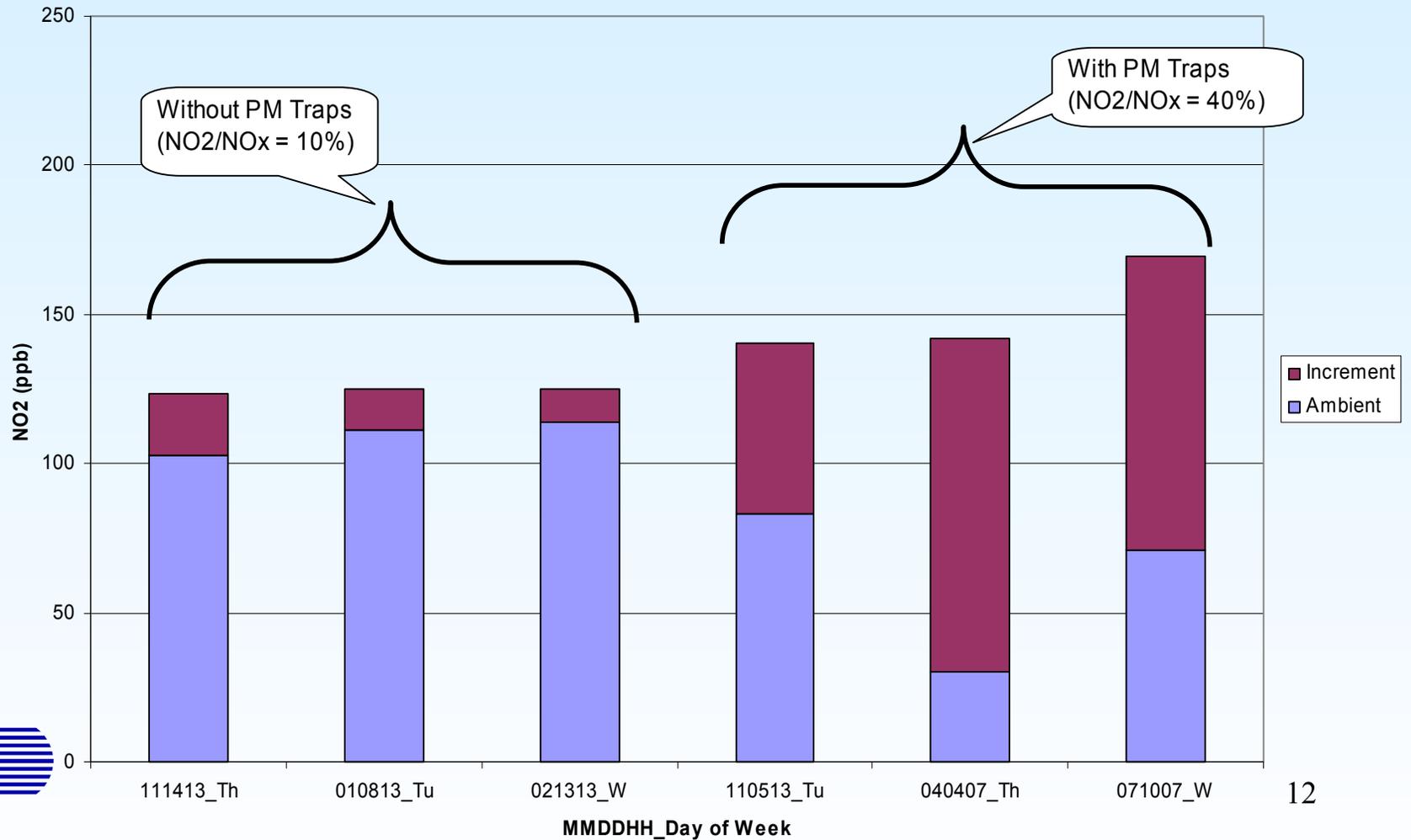
Idling School Buses 1-Hour Results

Table 1 – Refined 1-Hour NO₂ Impacts for Idling School Buses		
Particulate Control	Maximum ^{(b)(c)}	Note
W/O Traps (10% NO ₂)	120 ppb	(a)
W/Traps (40% NO ₂)	170 ppb	(a)
Notes:		
a) One Hour California State Standard for NO ₂ is 250 ppb		
b) Maximum based on 5 minutes idle, twenty buses in queue		
c) Ambient NO ₂ is included as background		



Idling School Buses - 1-Hour Results Overall Top 3 Maximum

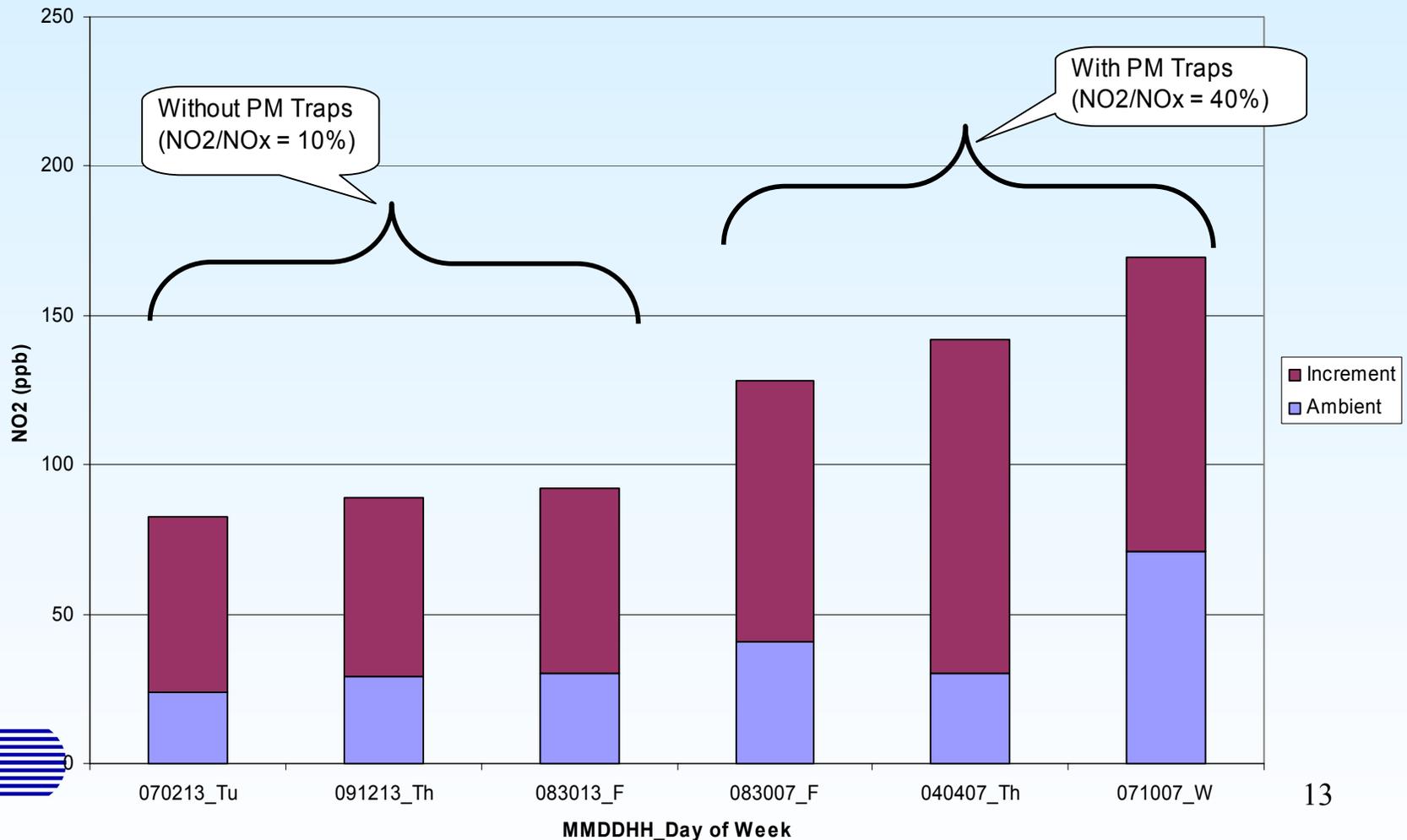
Idling School Buses 1-Hr NO2 Overall Top 3 Max



Idling School Buses - 1-Hour Results

3 Highest Above Ambient Impacts + Ambient

Idling School Buses 1-Hr NO₂ Above Ambient Top 3 Highest



Idling School Buses Annual Screening Results

**Table 2 – Screening
Above Ambient Annual Average NO₂ Impacts for Idling
School Buses**

Particulate Control	Minimum ^(b)	Maximum ^(c)	Note
W/O Traps (10% NO ₂)	0.2 ppb	5 ppb	(a)
W/Traps (50% NO ₂)	0.2 ppb	5 ppb	(a)

Notes:

- a) Annual Average Federal Standard is 53 ppb NO₂
- b) Minimum based on 2 minutes idle, five buses in queue, and 50 ppb background O₃
- c) Maximum based on 15 minutes idle, twenty buses in queue, and 100 ppb background O₃



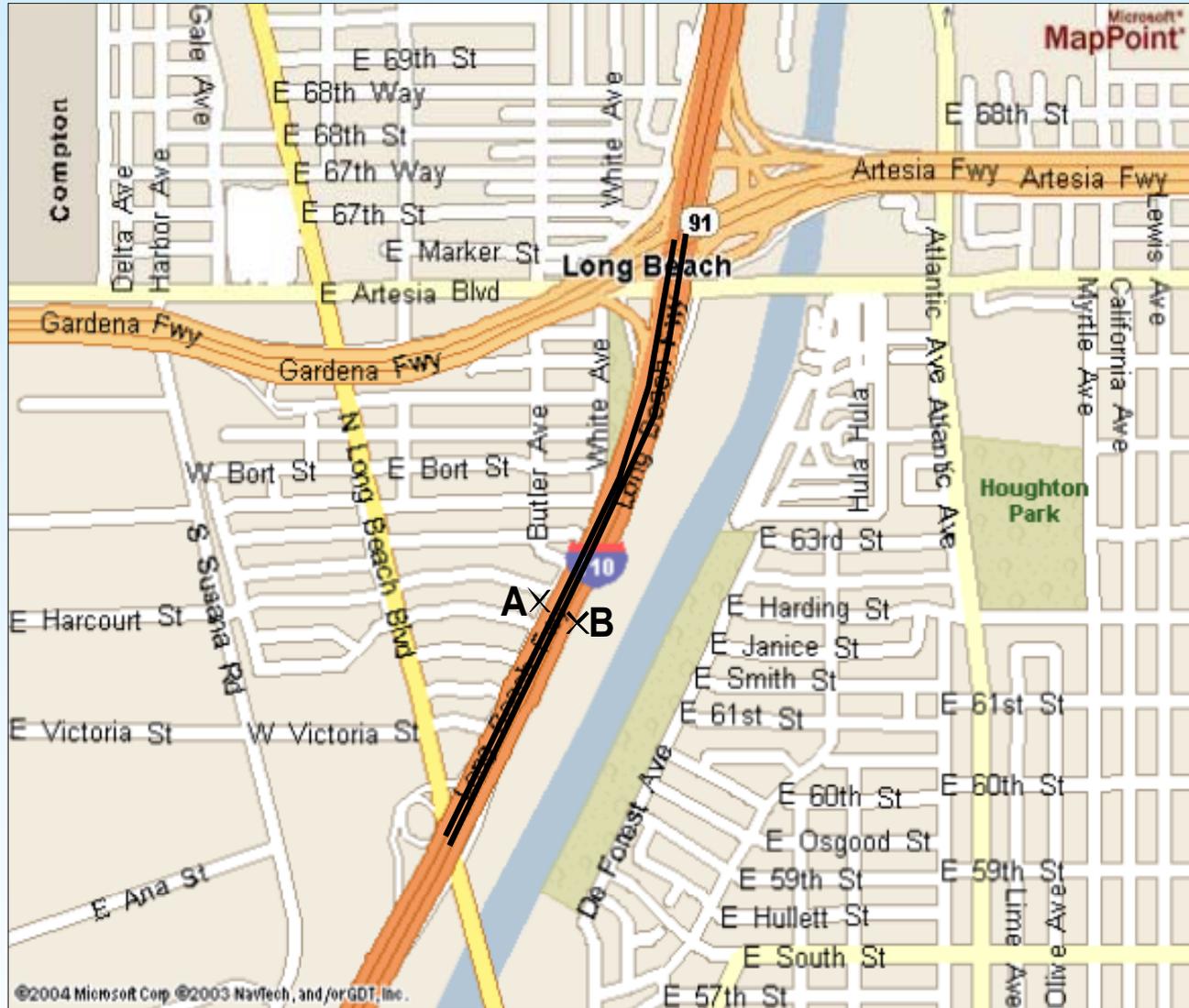
High Volume Freeway Details

High Volume Freeway

- 26,312 trucks per day average
 - 99th percentile for 2000 in California
- 189,936 vehicle per day total weekday
- NO_x emissions (EMFAC2002 V2.2)
 - vehicle type, vehicle speed, ambient temperature, and relative humidity
 - 2010 fleet emissions with 90% penetration
- Hourly Ambient Data and Met. Data
 - 2002 North Long Beach
- CAL3QHCR



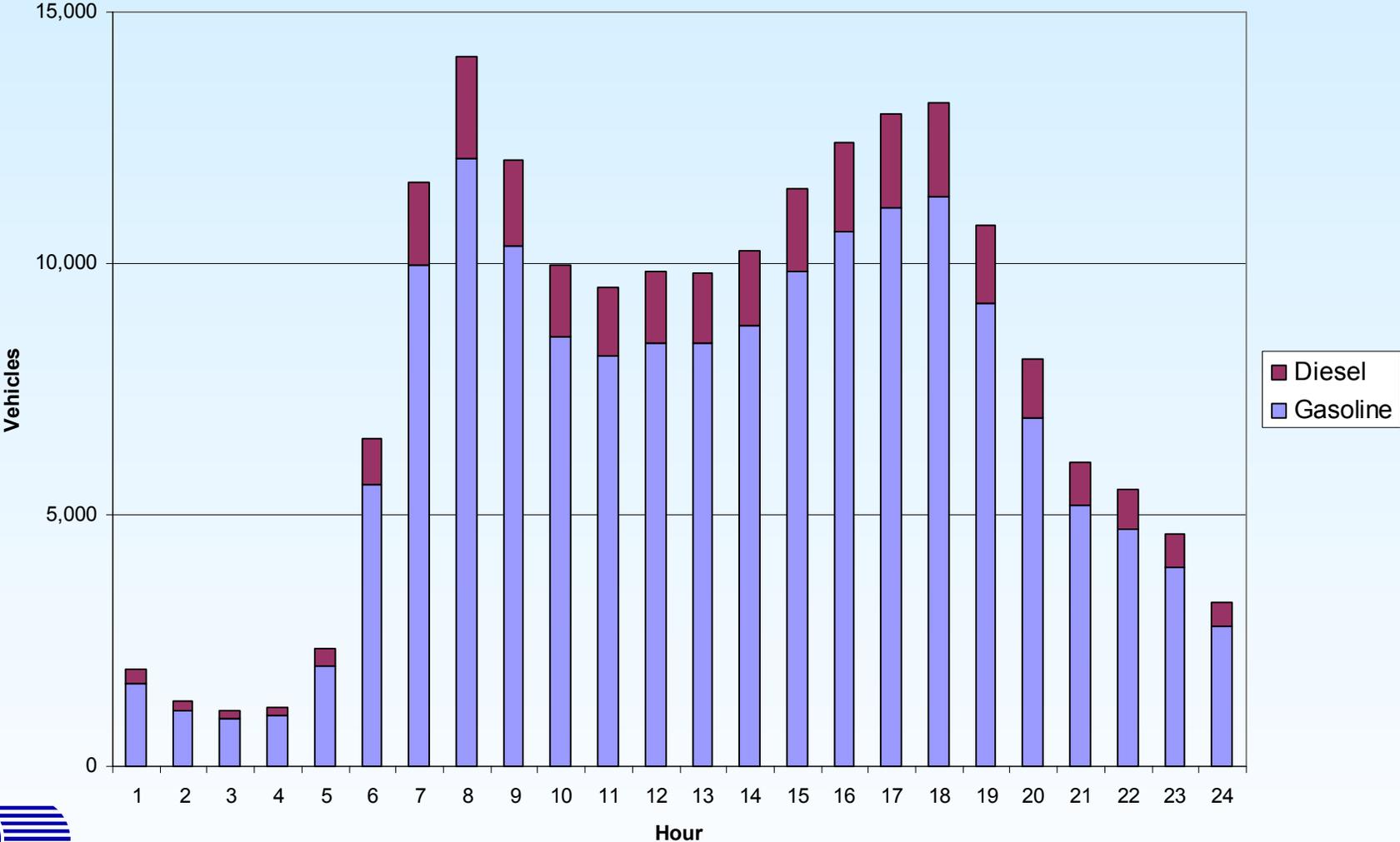
Receptors at 20 meters from Edge



0 m 500 m 1,000 m

Weekday Diurnal Traffic Volume

Hourly Freeway Volume - Weekday

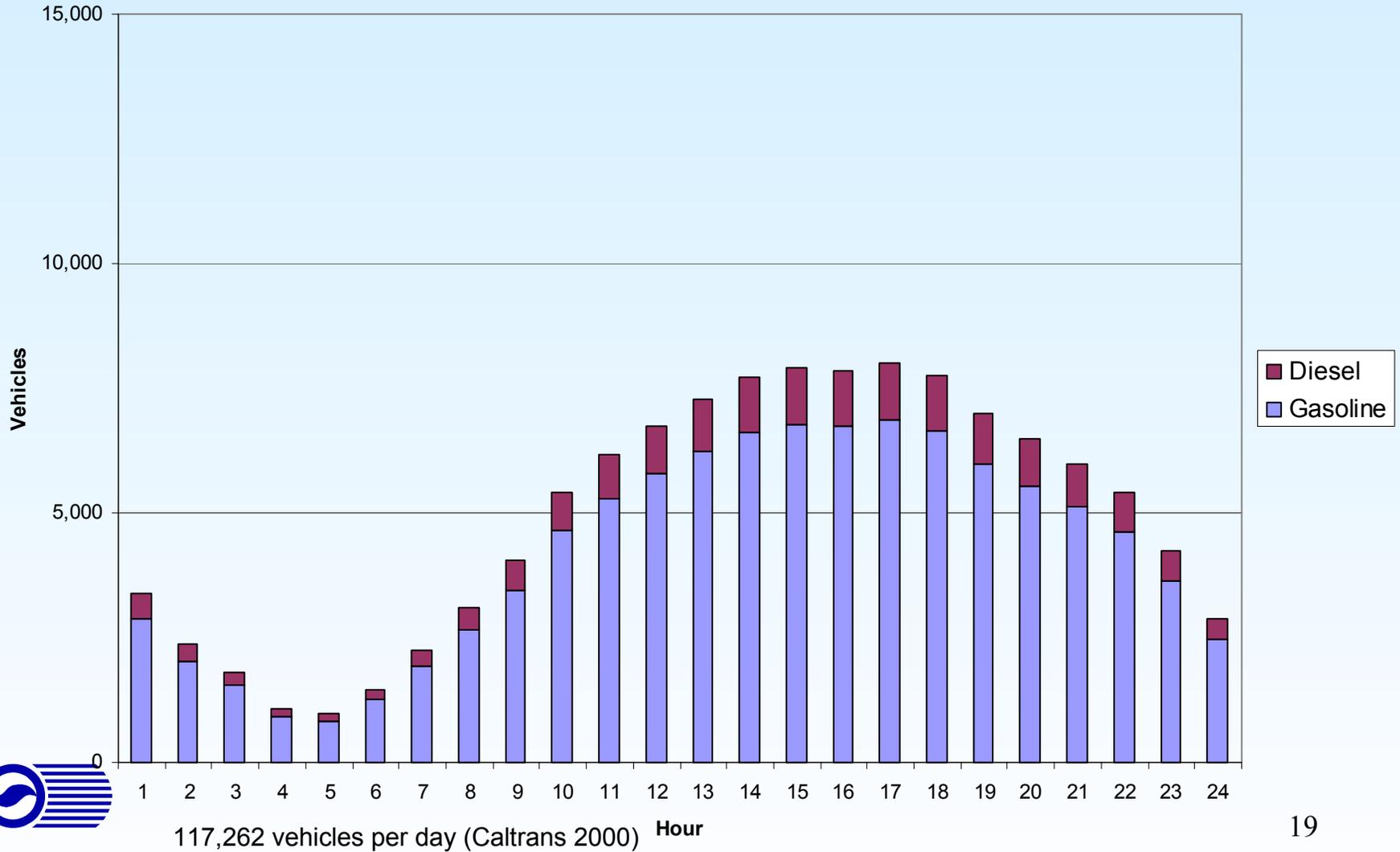


189,936 vehicles per day (Caltrans 2000)



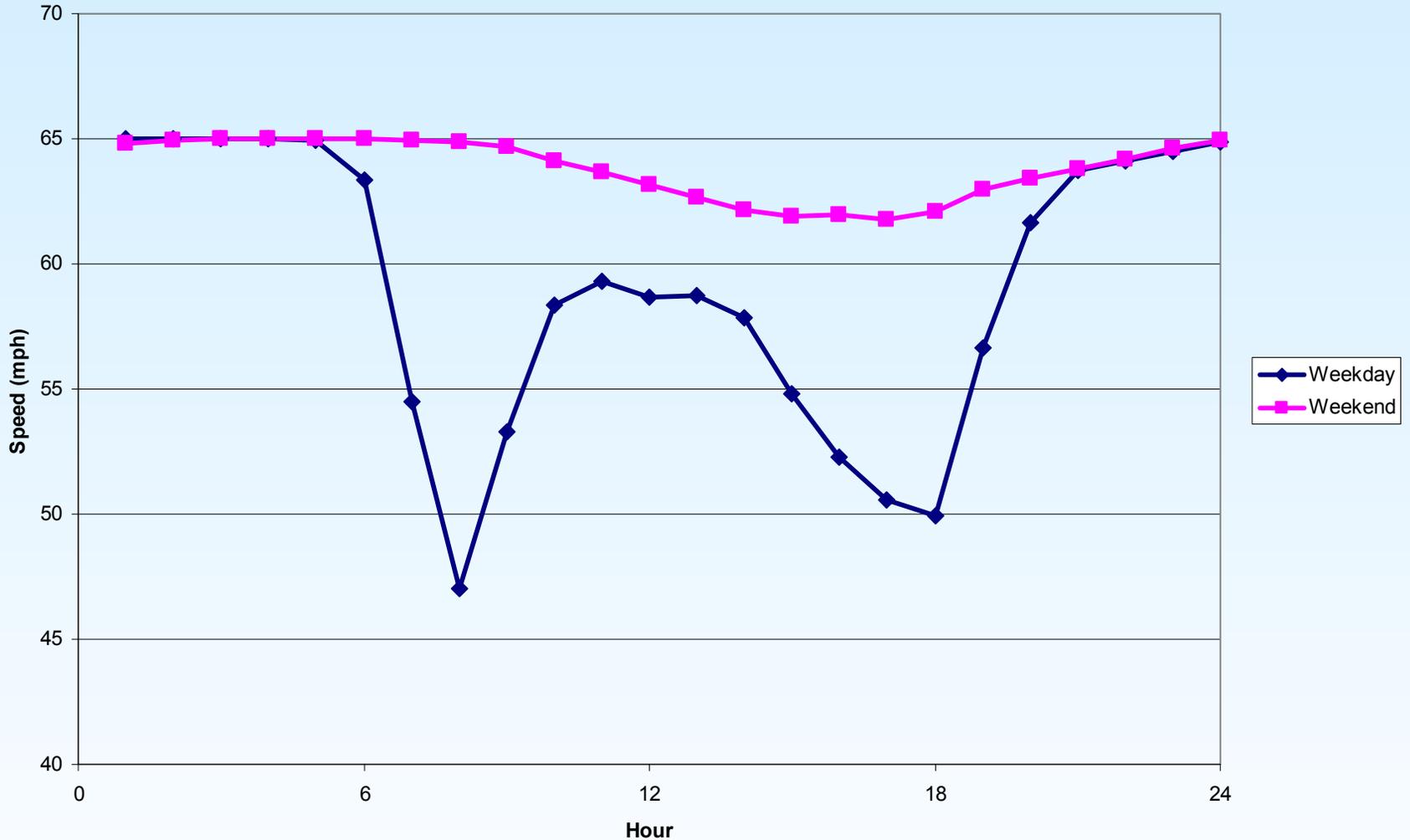
Weekend Diurnal Traffic Volume

Hourly Freeway Traffic - Weekend



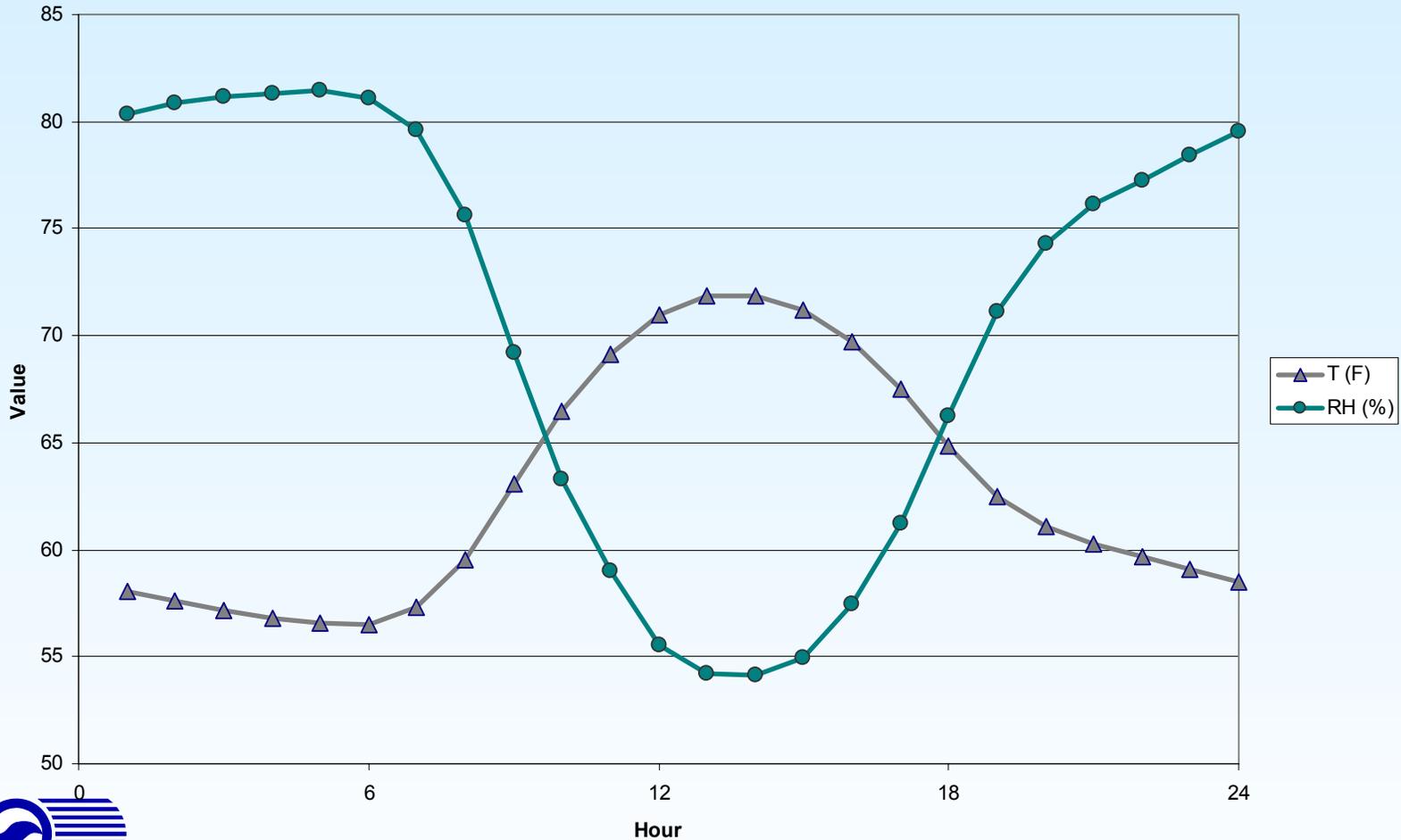
Long Beach Freeway Vehicle Speed

Diurnal Freeway Speed



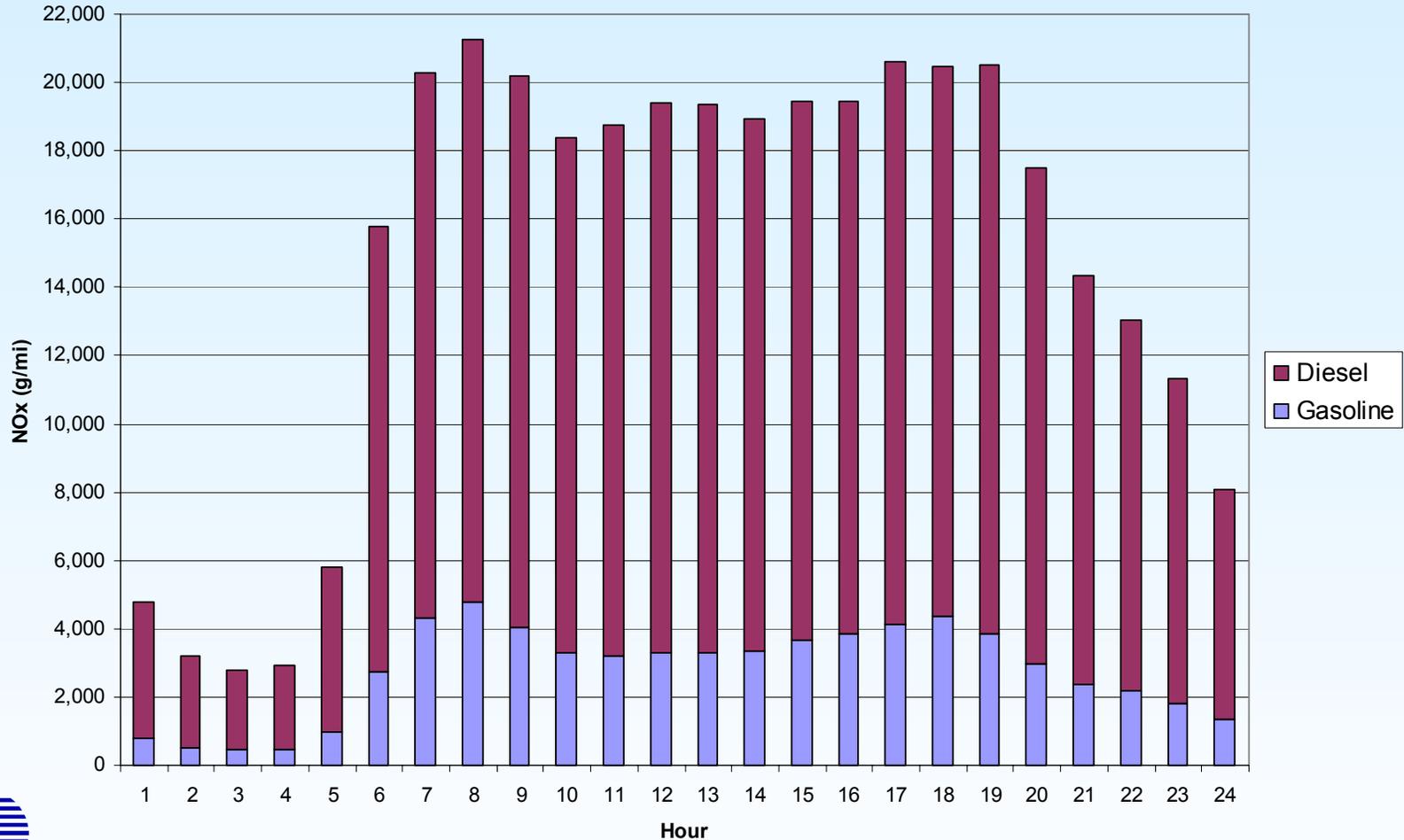
Average North Long Beach Temperature and Relative Humidity

NLB Diurnal T and RH



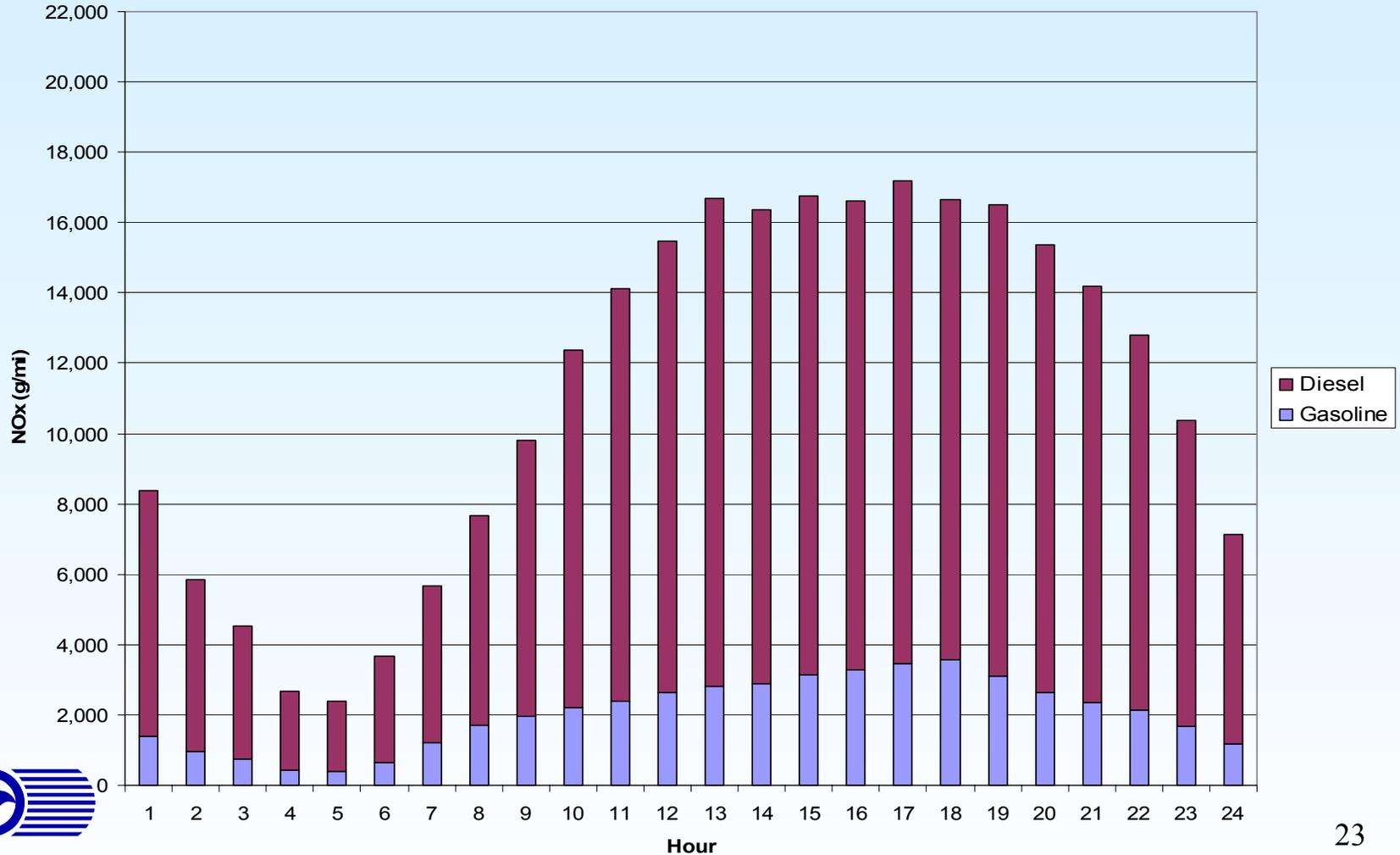
Weekday Diurnal NOx Emissions

Weekday NOx Emissions (Hourly) - LB Freeway



Weekend Diurnal NOx Emissions

Weekend NOx Emissions (Hourly) - LB Freeway



High Volume Freeway 1-Hour Results

**Table 3 – Refined
1-Hour NO₂ Impacts for High Volume Freeway**

Particulate Control	Maximum ^(b)	Note
W/O Traps (10% NO ₂)	150 ppb	(a)
W/Traps (40% NO ₂)	180 ppb	(a)

Notes:

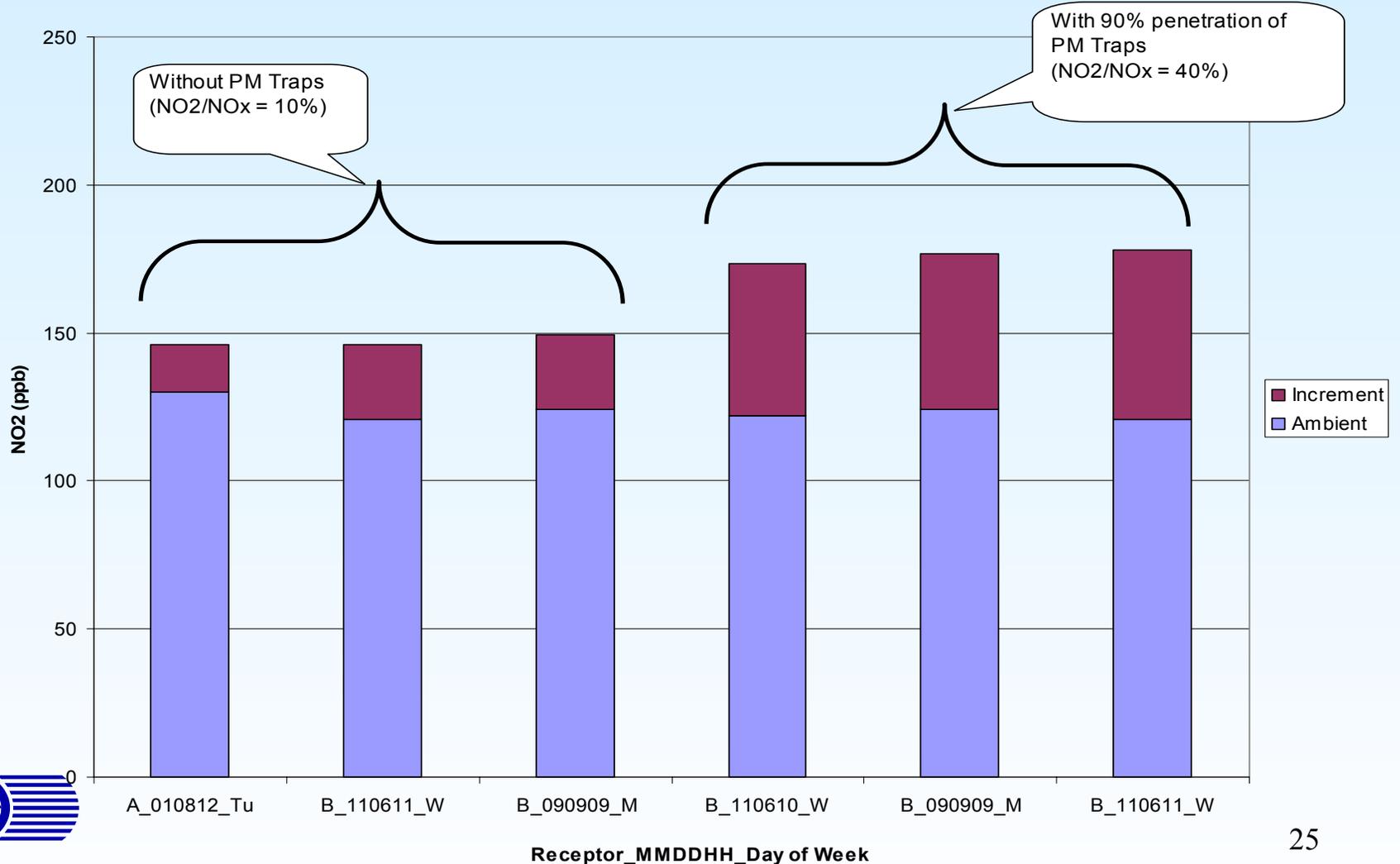
(a) One Hour California State Standard for NO₂ is 250 ppb

(b) Ambient NO₂ is included as background



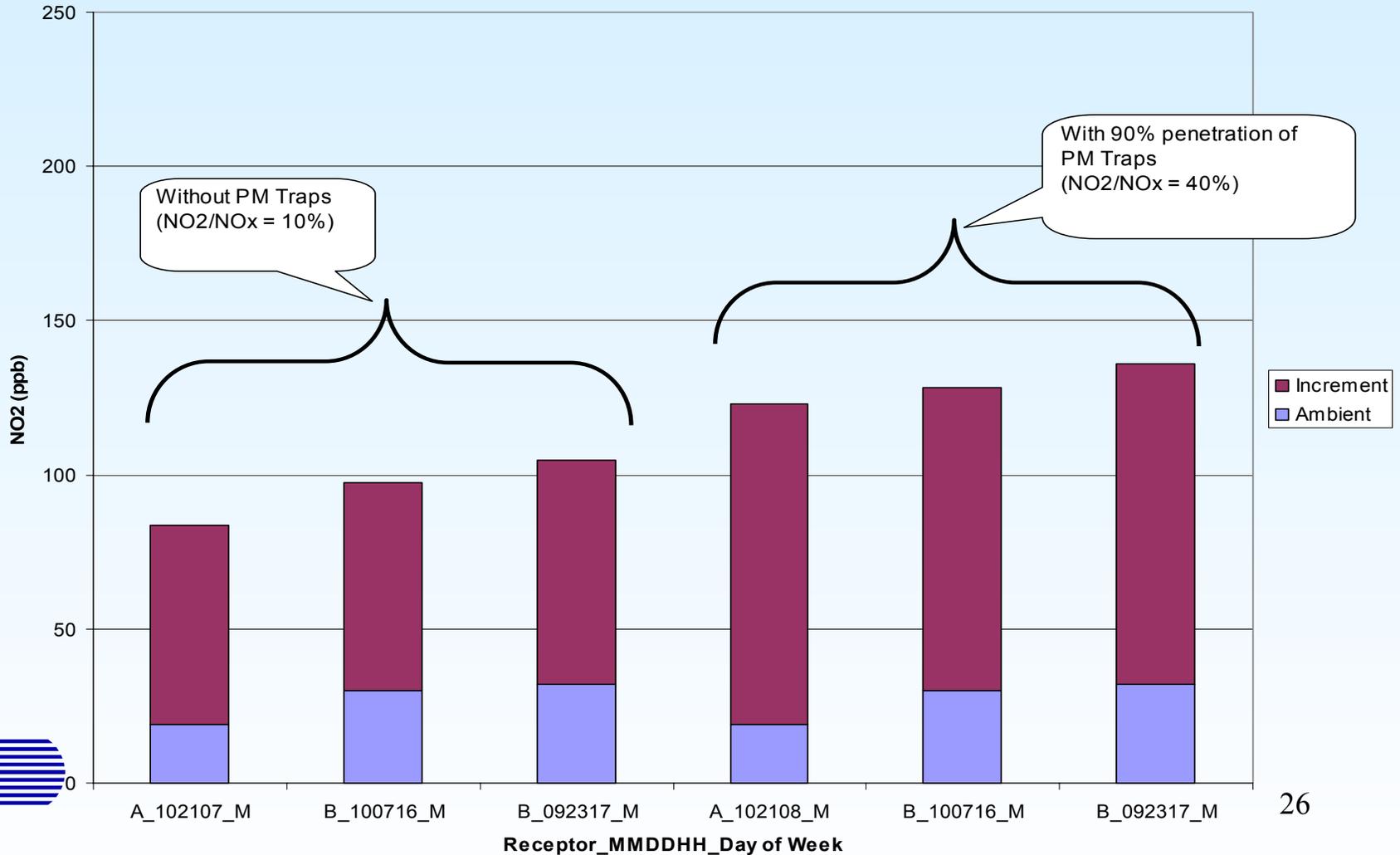
Freeway - Maximum Impacts due to Higher Ambient Levels

Freeway 1-Hr NO2 Overall Top 3 Max



Freeway - Maximum Freeway Contribution Not Coincident with High Ambient Levels

Freeway 1-Hr NO₂ Above Ambient Top 3 Highest



High Volume Freeway Annual Screening Results

**Table 4 – Screening
Above Ambient Annual Average NO₂ Impacts for High Volume
Freeway**

Particulate Control	Maximum ^(b)	Note
W/O Traps (10% NO ₂)	18 ppb	(a)
W/Traps (50% NO ₂)	18 ppb	(a)

Notes:

(a) Annual Average Federal Standard is 53 ppb NO₂

(b) Receptor located 20 meters from edge of freeway



Summary of Refined Analysis

Summary – 1 Hr NO₂

Table 5 – Summary of 1-Hour NO₂ Impacts due to Particulate Traps (a), (b)

Scenario	PM Traps: No (10% NO ₂ /NO _x)	PM Traps: Yes (40% NO ₂ /NO _x)
Idling School Buses ^(c)	120 ppb	170 ppb
Freeway ^(d)	150 ppb	180 ppb

- (a) These results include ambient hourly NO₂ as background.
- (b) The California State standard for 1-Hr NO₂ is 250 ppb.
- (c) Idling School Buses include 20 buses idling for 5 minutes with hourly O₃.
- (d) High Volume Freeway is for 26,312 trucks per day with hourly O₃.

