

Mobile Monitoring of NO/NO₂ in Los Angeles
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On-Road NO₂ Measurements

From February through April, 2003, the ARB conducted roadway measurements using an instrumented RAV4 electric vehicle, driven on freeways, arterial roads, and residential streets in Los Angeles. NO_x, NO and NO₂ were measured in real-time with an API 220E unit (chemiluminescence method), with a 10 second averaging time. Other analytes included black carbon, particle-bound PAHs, ultrafine particle (UFP) number concentrations, UFP size distributions, PM_{2.5} mass (some runs), CO, and CO₂.

The freeway driving centered around a loop having a large contrast in diesel truck volumes. The loop began near USC, went east on the 10 freeway, and connected via short lengths on the 60 and 5 freeways to the 710 south to Long Beach. A short time was spent in a residential area of Long Beach, then the route was re-traced, with an additional segment taken on the 110 north to Pasadena and back to USC. Truck volumes ranged from about 14% trucks on the 710 to about 1% on the 110. Overall traffic volumes were heavy on all freeways except the northernmost portion of the 110 approaching Pasadena.

Four freeway days have been analyzed: Feb. 14 and 20, and April 7 and 16. Average NO and NO₂ concentrations for these days are:

Date (2003)	Time of Day	NO (ppb) mean±stdev	NO ₂ (ppb) mean±stdev	% NO ₂ of Total NO _x
Feb 14	13:45-17:45	190 ± 130	47 ± 50	20
Feb 20	11:00-12:50	210 ± 140	40 ± 50	16
April 7	9:35-11:25	380 ± 130	54 ± 10	12
Apr 16	11:30-1:40	280 ± 190	68 ± 50	19

From these figures it appears the fraction of NO_x that was NO₂ was fairly consistently in the 15 to 20% range, although NO₂ averaged from 40 to 70 ppb.

NO/NO₂ Concentrations by Location

NO/ NO₂ concentrations varied widely by location. The following table shows NO and NO₂ concentrations by road segment for the same four days. The numbers listed are the average and standard deviation of the daily averages:

Location	NO (ppb)	NO ₂ (ppb)	% of Total NO _x that is NO ₂	Number of Days
Long Beach residential	19 ± 7	26 ± 7	57 ± 10	4
Pasadena residential	16 ± 7	23 ± 16	57 ± 7	3
USC start	60 ± 34	39 ± 12	41 ± 11	4
USC finish	34 ± 19	38 ± 14	54 ± 17	3
Arterial roads north of USC	82 ± 47	36 ± 20	31 ± 12	3
110N freeway (~3500 TrPD)	182 ± 63	54 ± 8.3	24 ± 4.3	4
10E freeway (~10,000 TrPD)	272 ± 44	49 ± 13	16 ± 5.5	4
710S freeway (~25,000 TrPD)	406 ± 128	66 ± 26	15 ± 0.6	4

TrPD = average number of diesel-powered trucks per day

NO concentrations appeared to be a strong function of traffic volume, particularly truck traffic volumes (listed as average trucks per day, TrPD), while NO₂ showed a less pronounced relationship. The average daily vehicle counts for these freeway segments from CalTrans were 210, 270, and 180 thousand per day, for the 110N, 10E, and 710S, respectively, so vehicle volume showed much less variation than the truck volumes.

The fraction of NO_x that is NO₂ appeared to have an inverse relationship with total NO concentrations, ranging from nearly two-thirds of the total in residential locations to only 15% on the 710 with its heavy diesel truck traffic. This is likely due to the reaction of traffic-generated NO with ozone.