Modeling Deterioration of Running Emissions

Phil Enns

EPA Office of Mobile Sources

Modeling Deterioration of Running Emissions

◆ Data Sources

◆ Models

◆ Results

Data Sources

◆ IM240

– Ohio

– Arizona

– Colorado

◆ FTP

– Emission Factors Database

– Manufacturers

– API

Ohio IM 240

- ◆ 240,000 tests, model years 1975-96, from Dayton (no previous IM program)
- ◆ Fast Pass scores used to simulate 240
- ◆ Simulated 240 correlated with Running LA4
- ◆ Conclusions
  - – No indication of accelerated deterioration
  - – Decision: May use Ohio truck data for model years not adequately represented by FTP data

Deterioration of Running LA4 Emissions

◆ FTP Data (AAMA, EPA, API)
  – used for
    ❖ carbureted vs. fuel injected
    ❖ model year groups
      – 1981-82
      – 1983-85
      – 1986-89
      – 1990-93
    ❖ cars vs. trucks

Fitted Models

◆ Linear

   – Emissions = A + B*Miles
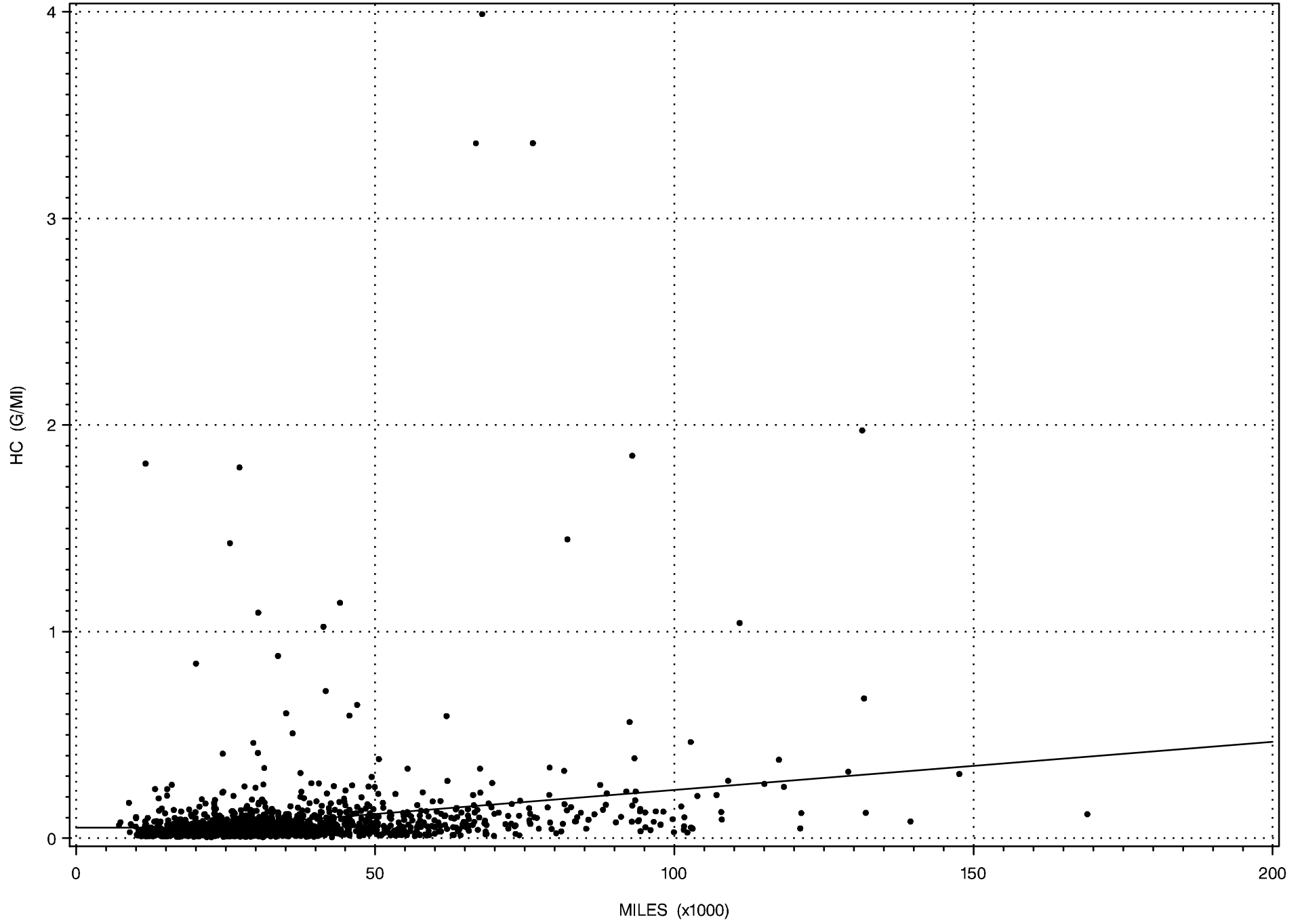
◆ Constrained Linear

   – Emissions = ZML + B*Miles

◆ Constrained Nonlinear

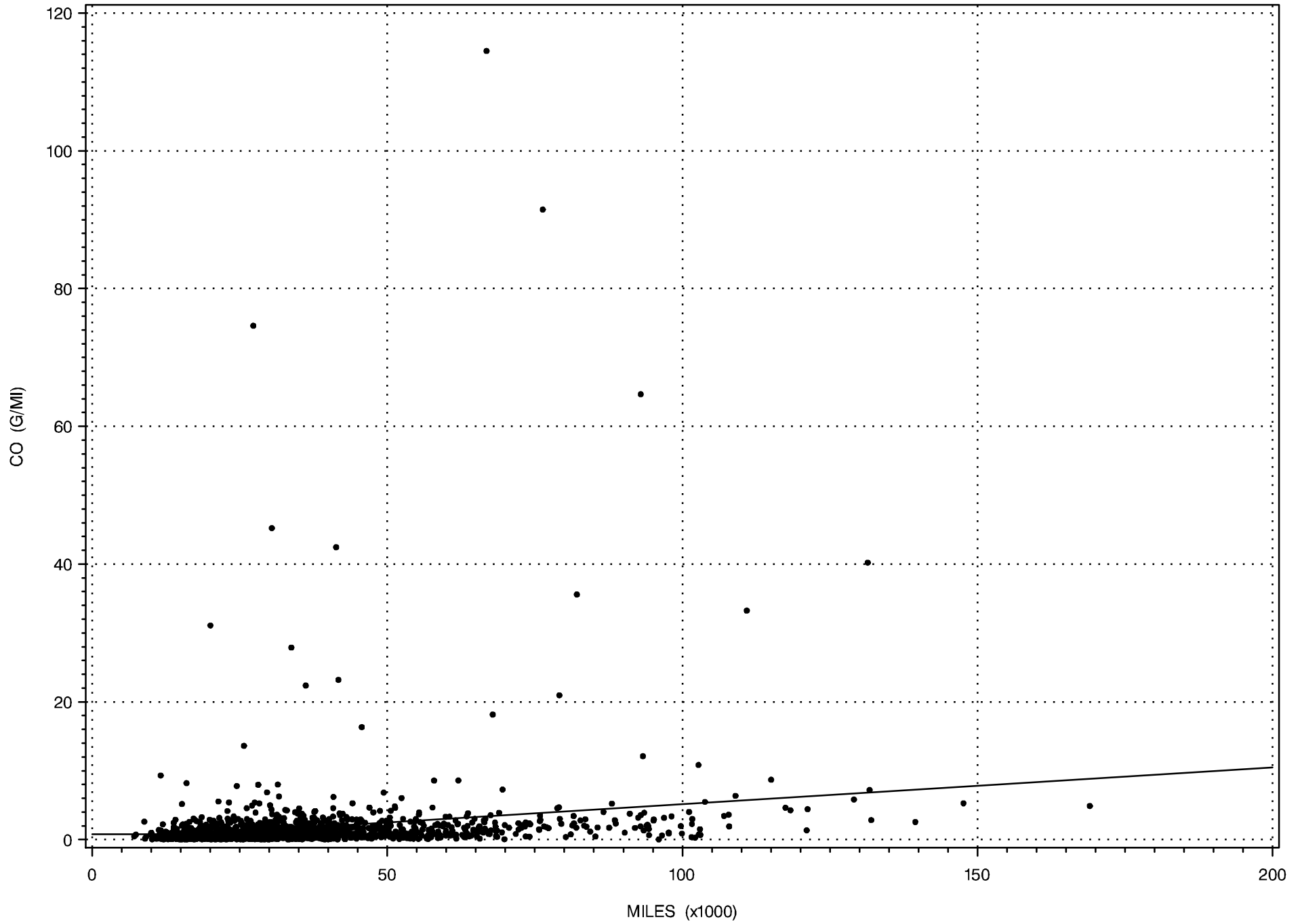   – Emissions = ZML + K*(Miles)^{B}

Proposed Solution

◆ Piecewise function

- – Constant emissions at low mileage
- – Constrained linear function through low mileage point, connected to...
- – Unconstrained linear function for high mileage

RUNNING LA4 HC: 1990−93 PFI CARS with PROJECTED MOBILE6
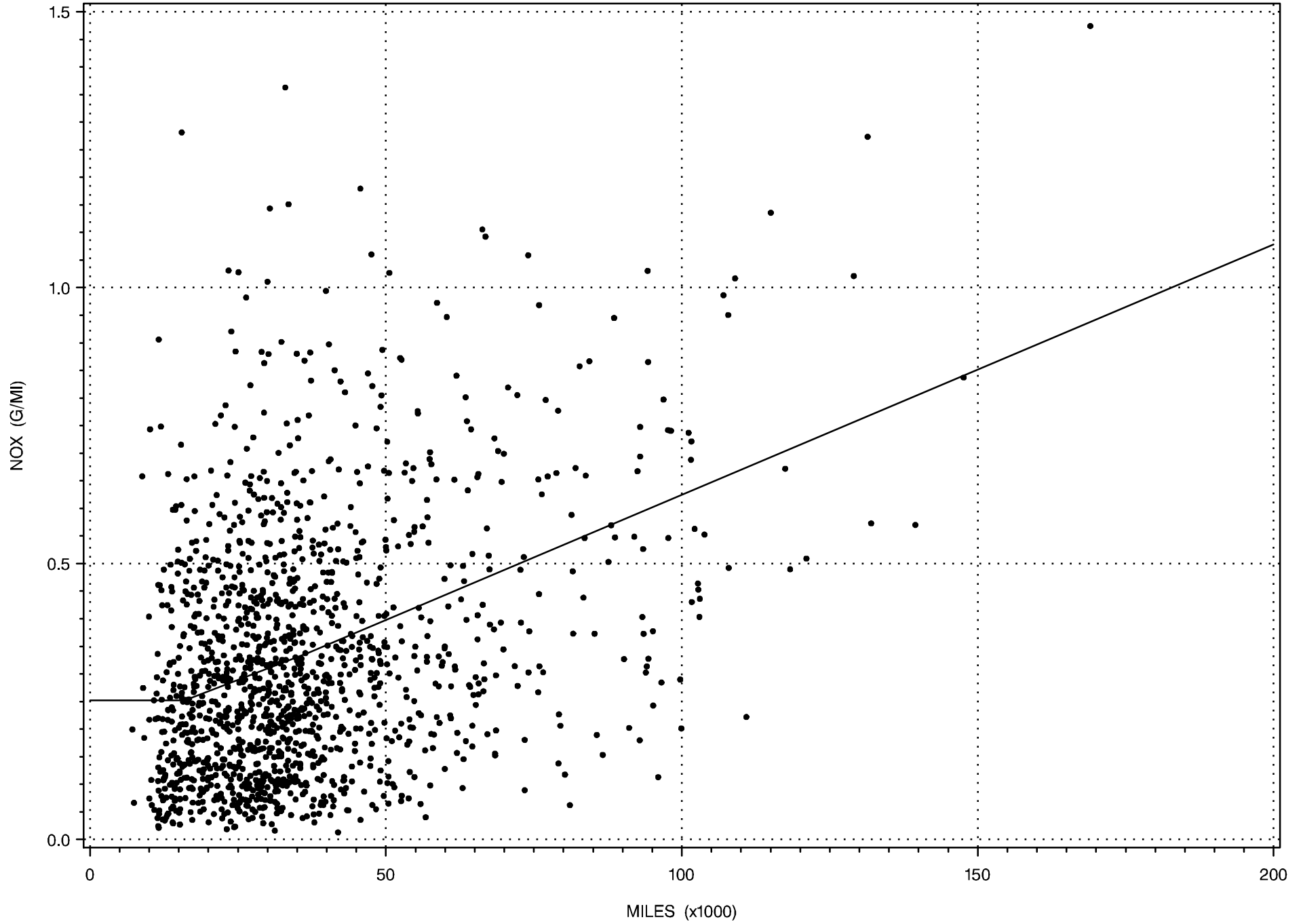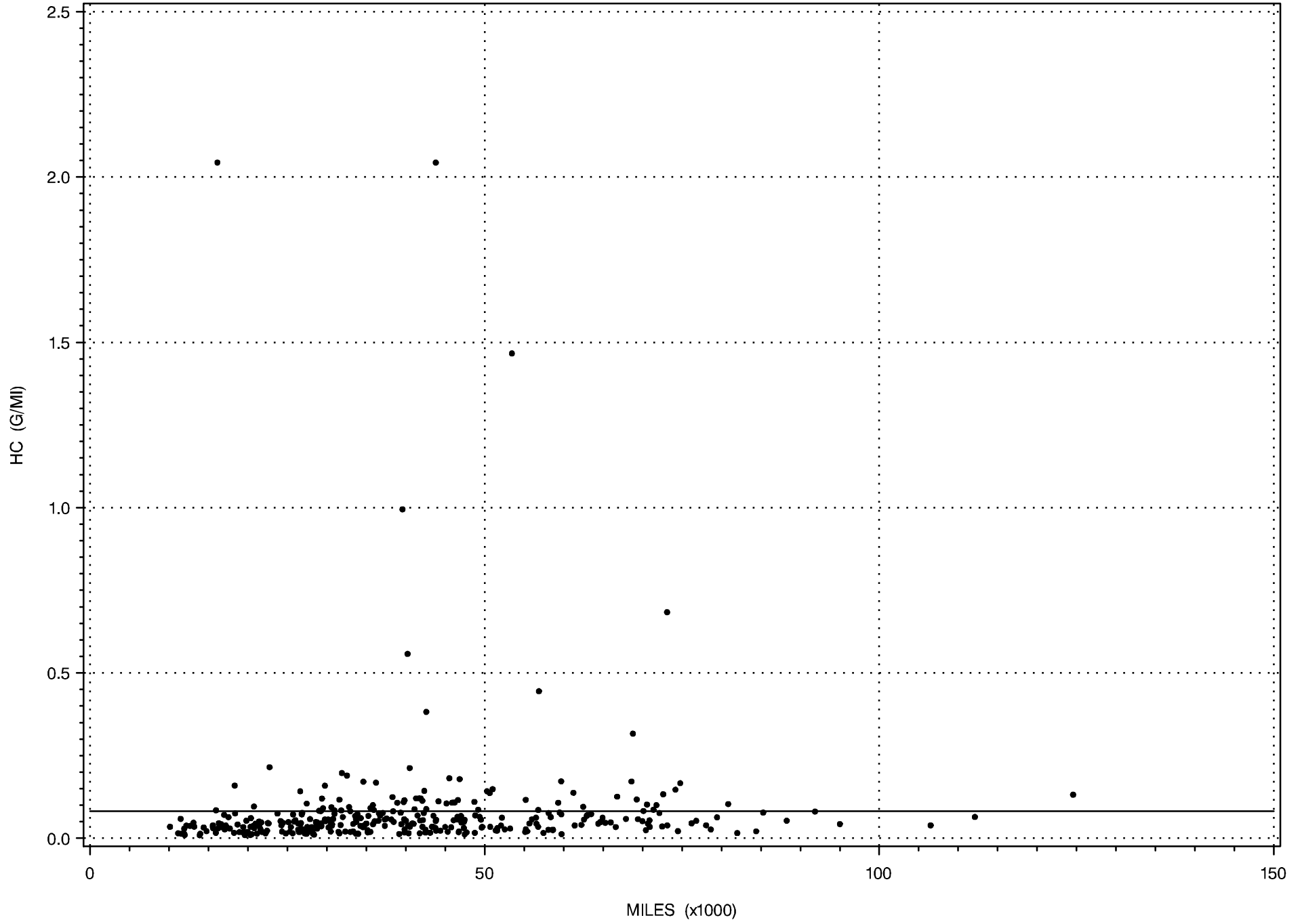
HC (G/MI)

MILES (x1000)

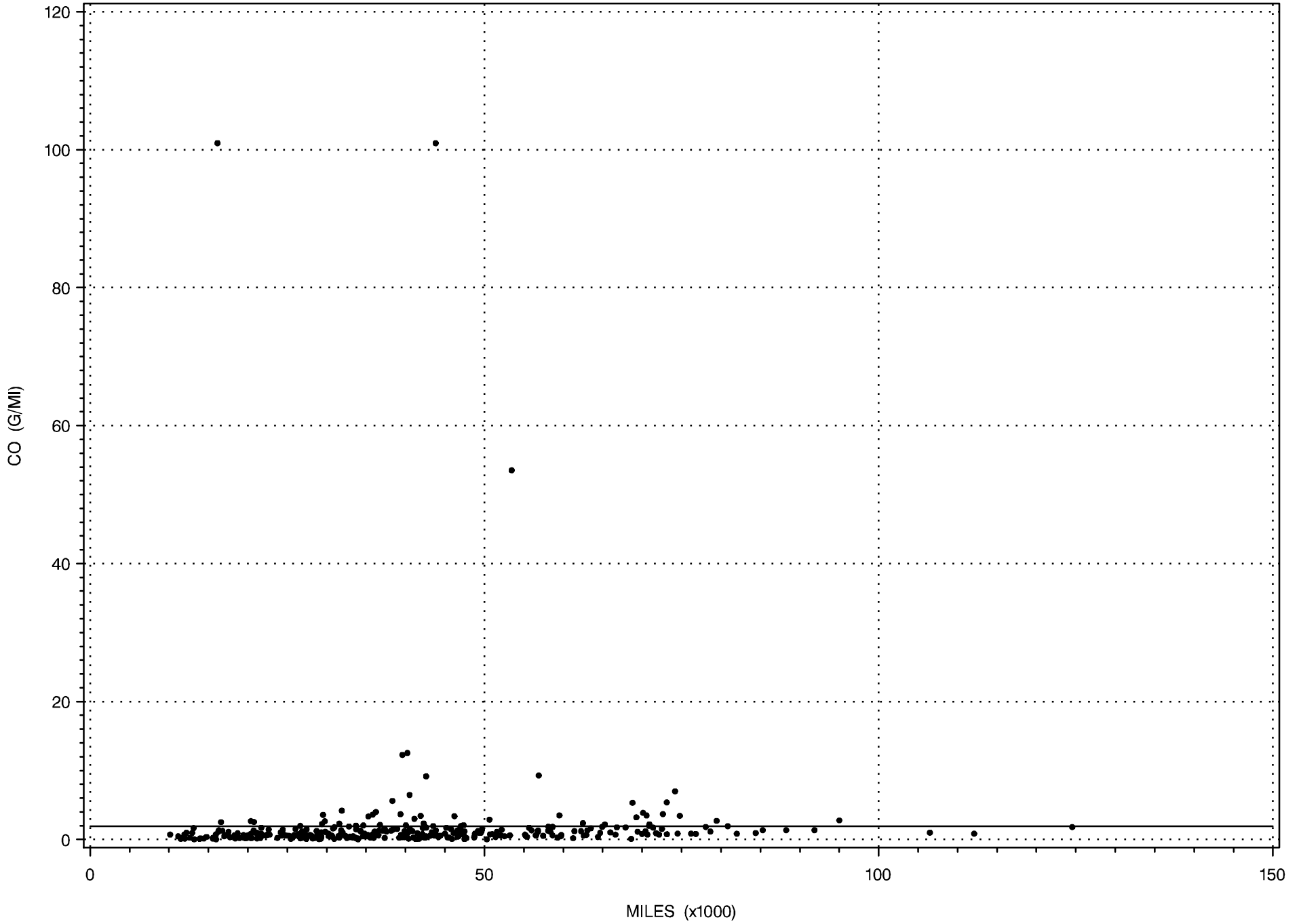RUNNING LA4 CO: 1990−93 PFI CARS with PROJECTED MOBILE6

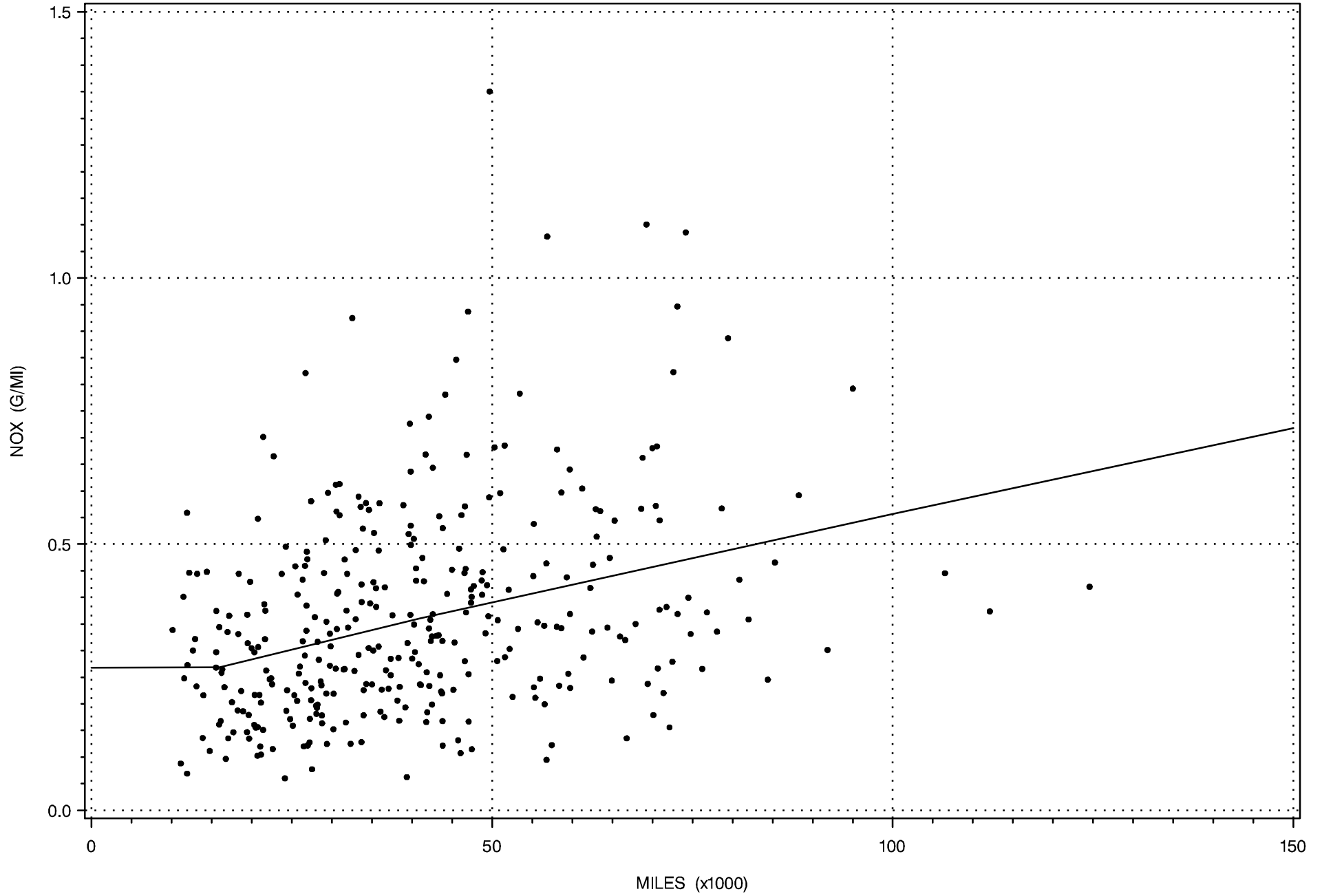RUNNING LA4 NOX: 1990-93 PFI CARS with PROJECTED MOBILE6

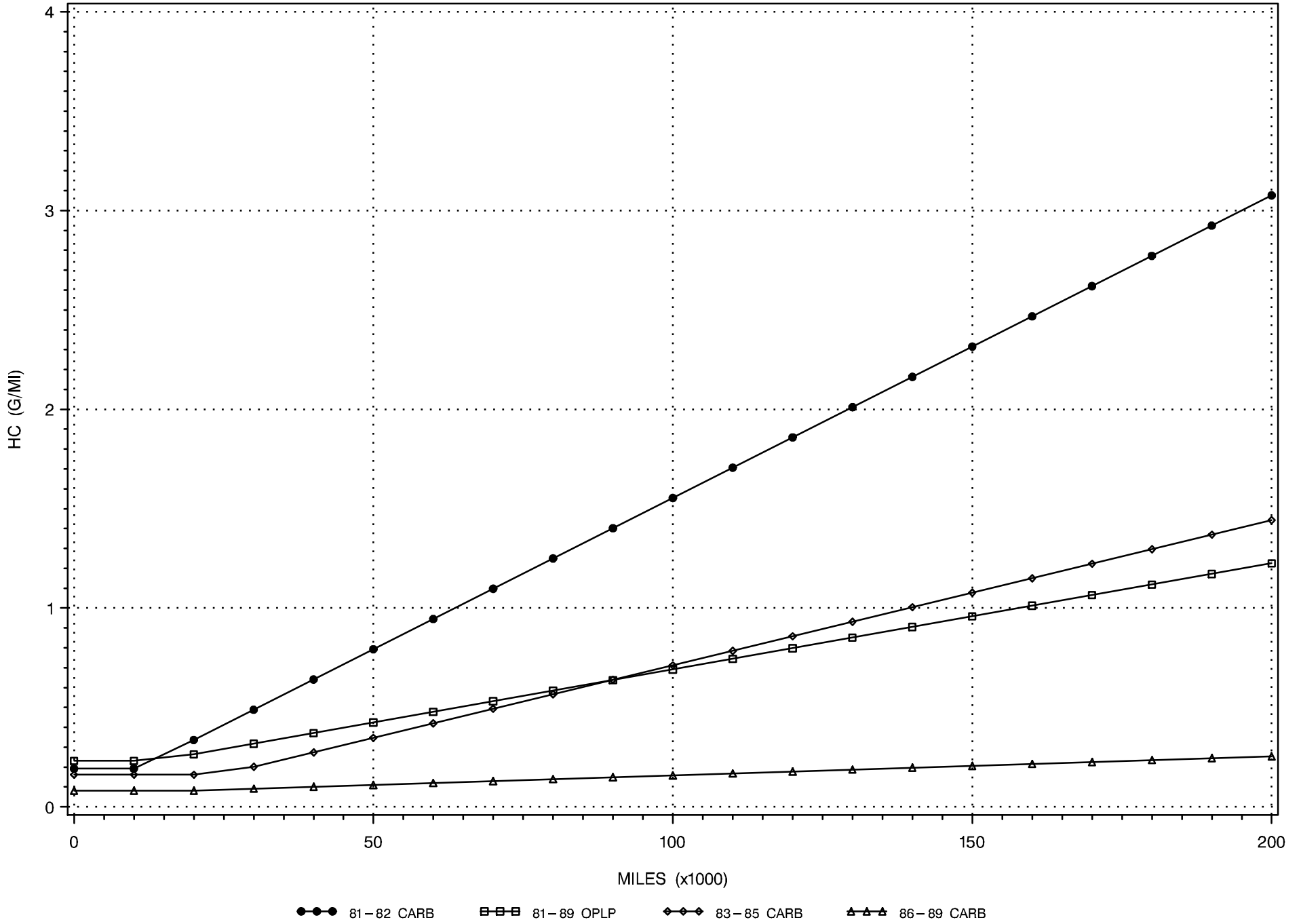RUNNING LA4 HC: 1990-93 TBI CARS with PROJECTED MOBILE6

RUNNING LA4 CO: 1990−93 TBI CARS with PROJECTED MOBILE6
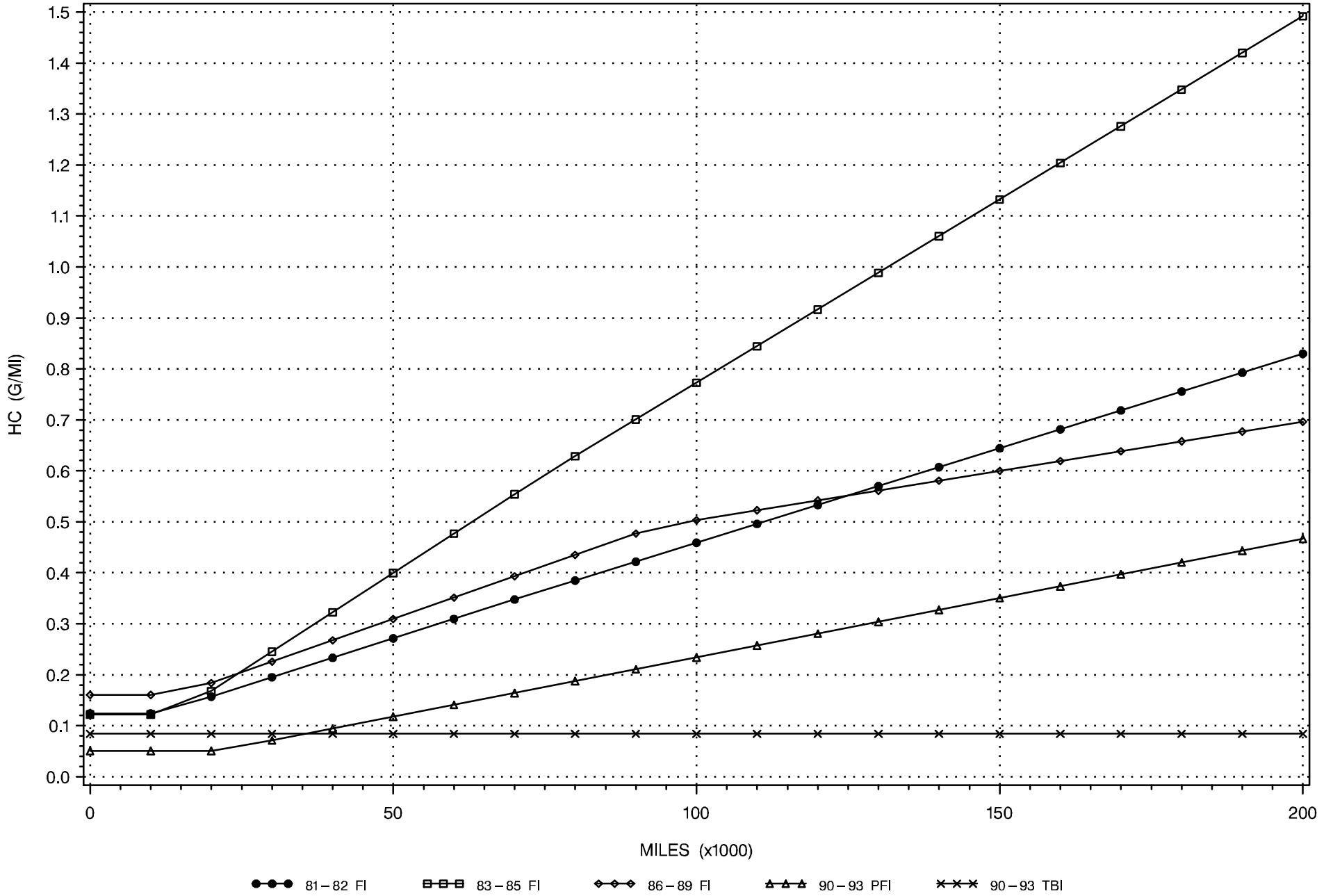
RUNNING LA4 NOX: 1990−93 TBI CARS with PROJECTED MOBILE6

NOX (G/MI)

MILES (x1000)

DRAFT Oct. 1, 1997

RUNNING LA4 HC: OPEN LOOP AND CARBURETED CARS

HC (G/MI)

MILES (x1000)

●●● 81-82 CARB   ▫▫▫ 81-89 OPLP   ◇◇◇ 83-85 CARB   △△△ 86-89 CARB

RUNNING LA4 HC: FUEL INJECTED CARS

HC (G/MI) vs MILES (x1000)

Legend: ●−● 81−82 FI   ▫−▫ 83−85 FI   ◇−◇ 86−89 FI   △−△ 90−93 PFI   ✕−✕ 90−93 TBI

DRAFT October 1, 1997

RUNNING LA4 CO: OPEN LOOP AND CARBURETED CARS
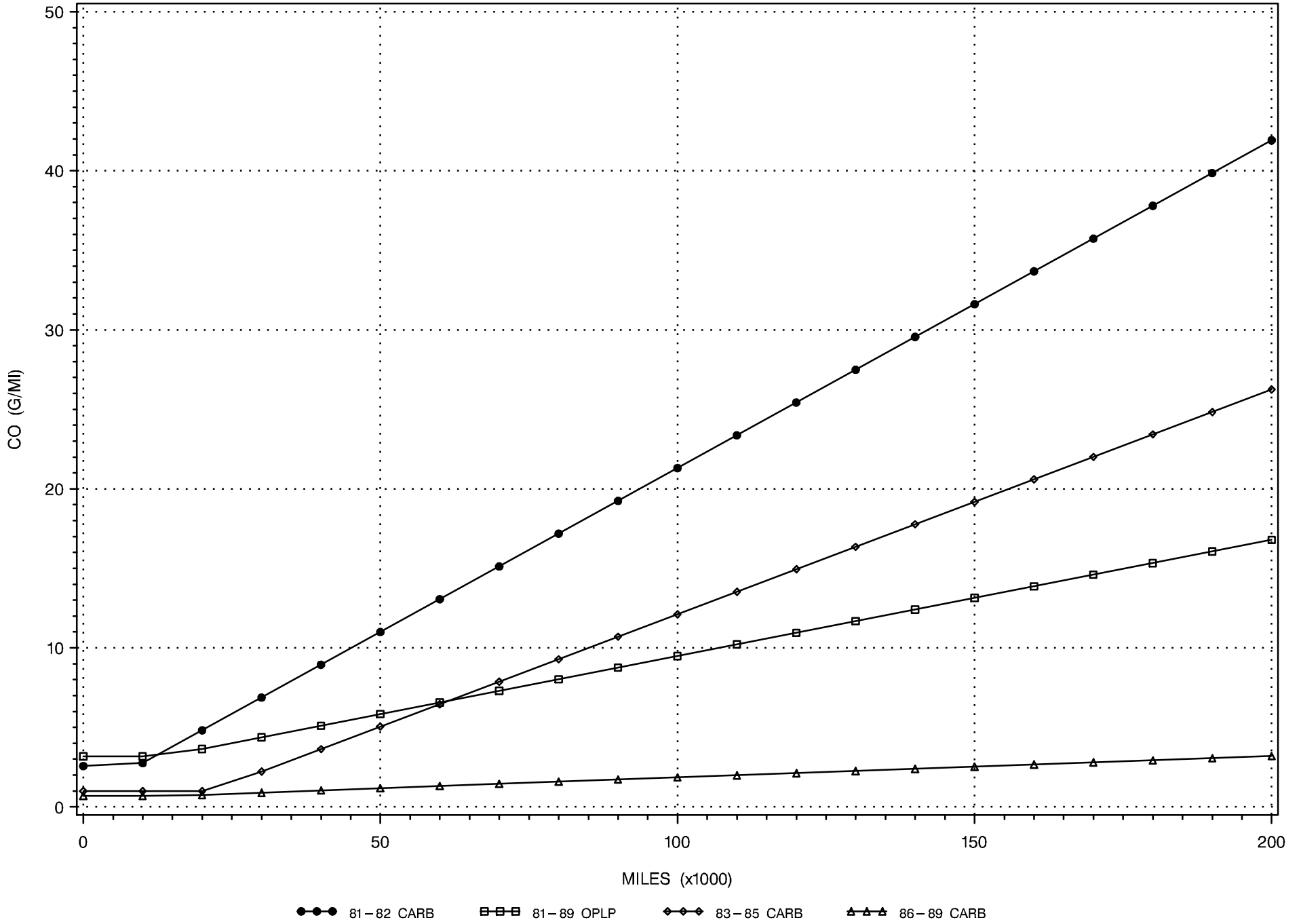
RUNNING LA4 CO: FUEL INJECTED CARS

CO (G/MI)

MILES (x1000)

●●● 81−82 FI   ▫▫▫ 83−85 FI   ◇◇◇ 86−89 FI   △△△ 90−93 PFI   ✕✕✕ 90−93 TBI

DRAFT October 1, 1997
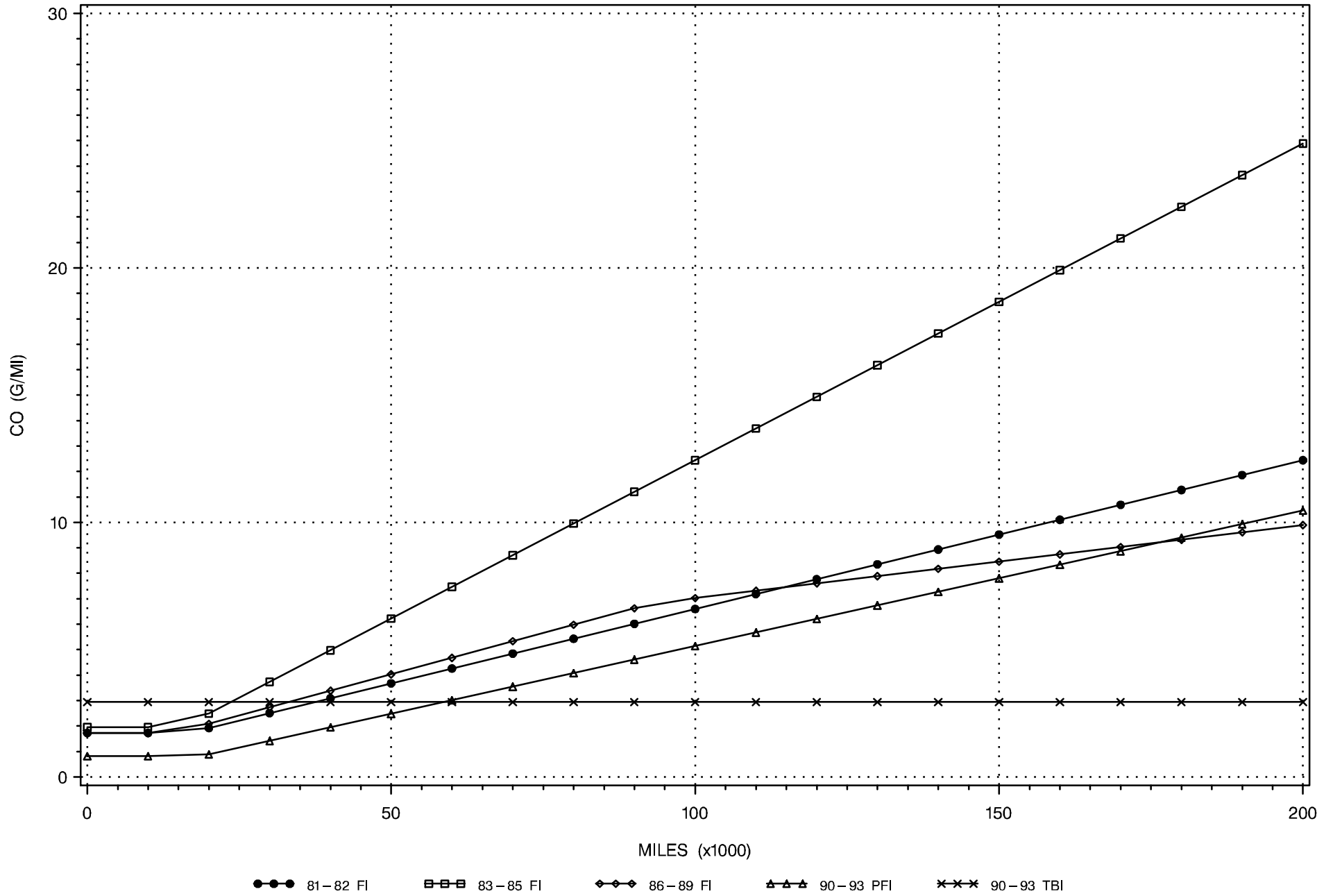
RUNNING LA4 NOX: OPEN LOOP AND CARBURETED CARS

NO (G/MI)

MILES (x1000)

●●● 81−82 CARB   ▱▱▱ 81−89 OPLP   ◇◇◇ 83−85 CARB   △△△ 86−89 CARB
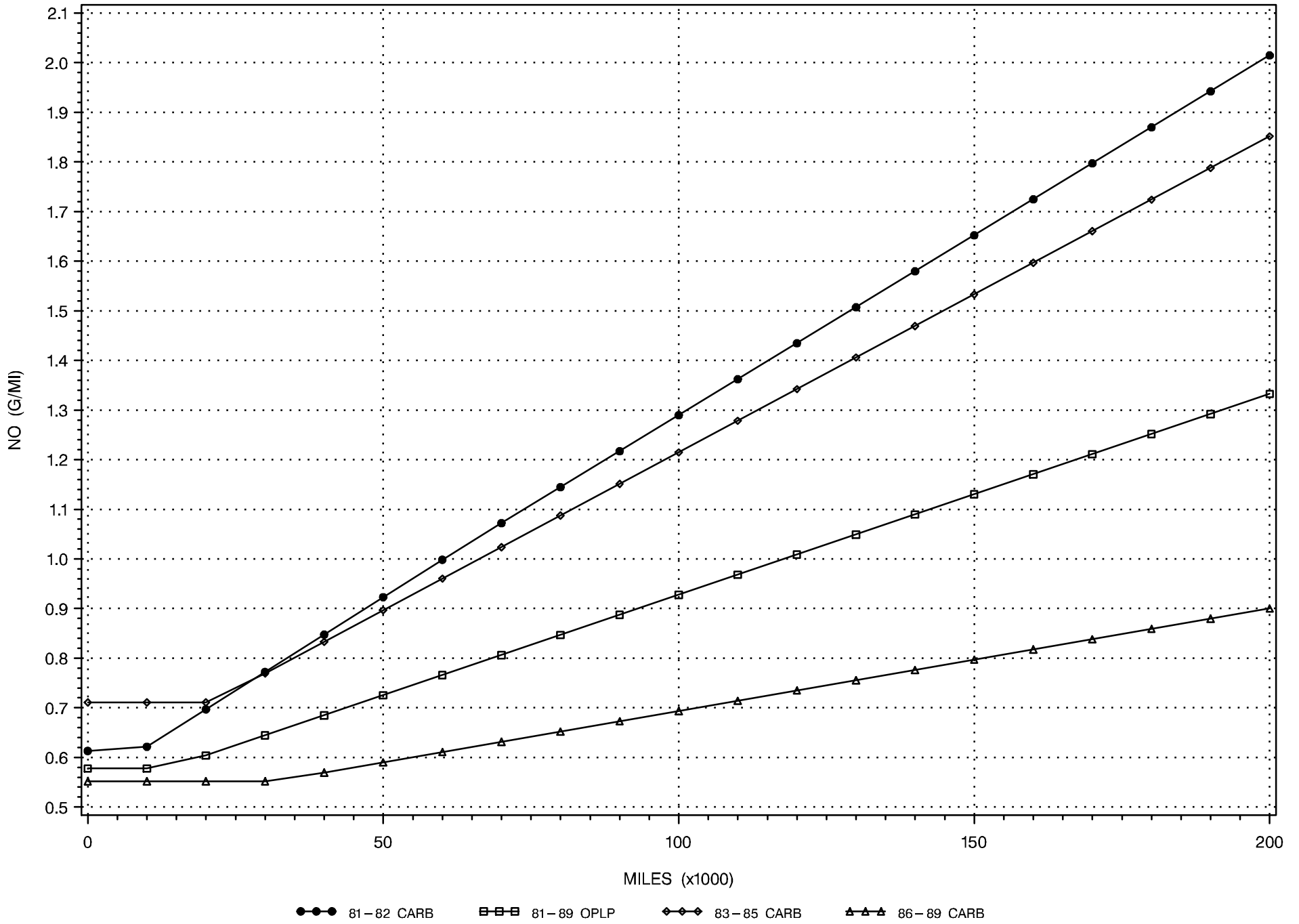
RUNNING LA4 NOX: FUEL INJECTED CARS

NO (G/MI)

MILES (x1000)

●─●─● 81-82 FI   ▣─▣─▣ 83-85 FI   ◆─◆─◆ 86-89 FI   △─△─△ 90-93 PFI   ✕─✕─✕ 90-93 TBI

DRAFT October 1, 1997