

Ethanol's Effects on Automotive Permeation

Ethanol Forum & Technical Roundtable

SQAMD Headquarters Room GB

June 15, 2006

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Mechanisms and Modes

Evap Emission Mechanisms

- Leaks
- Tank Venting
- Permeation

Operation Modes

- Diurnals
- Hot Soaks
- Running Losses
- Refueling Emissions

**AGING ENHANCED EVAPORATIVE EMISSIONS
CERTIFIED VEHICLES
CRC Project No. E-77**

- A pilot study to measure the evaporative emission mechanisms from 10 in-use vehicles
- The vehicles range from pre-enhanced evap to advanced technology “near-zero” models
- The study is a pilot intended to proceed to a more comprehensive program
- Vehicle tests start in June 2006 at ATL-Mesa

FUEL PERMEATION FROM AUTOMOTIVE SYSTEMS

CRC Project E-65

Presented at the
15th CRC On-Road Vehicle Emissions Workshop
San Diego, CA

Harold Haskew - HH&A
Dennis McClement – ATL-AZ

April 6, 2005

Genesis

- California banned MTBE in gasoline
- Rule was created in 1999 – Ban started 2004
- Ethanol was the only suitable oxygenate
- By law, no “back-sliding” was allowed
- The permeation increase was unknown
- CRC and ARB sponsored the test program
- Substantial API and Auto support

Program Overview

- Ten Vehicle Fuel Systems
- Three Fuels
 - A. CA Phase 2 (11.4V% MTBE)
 - B. CA Phase 3 (5.7V% EtOH)
 - C. CA Phase 2 w/No Oxygenate
 - Circulate fuel twice weekly – Fuel change every 7 weeks



E-65 California Fleet Selection

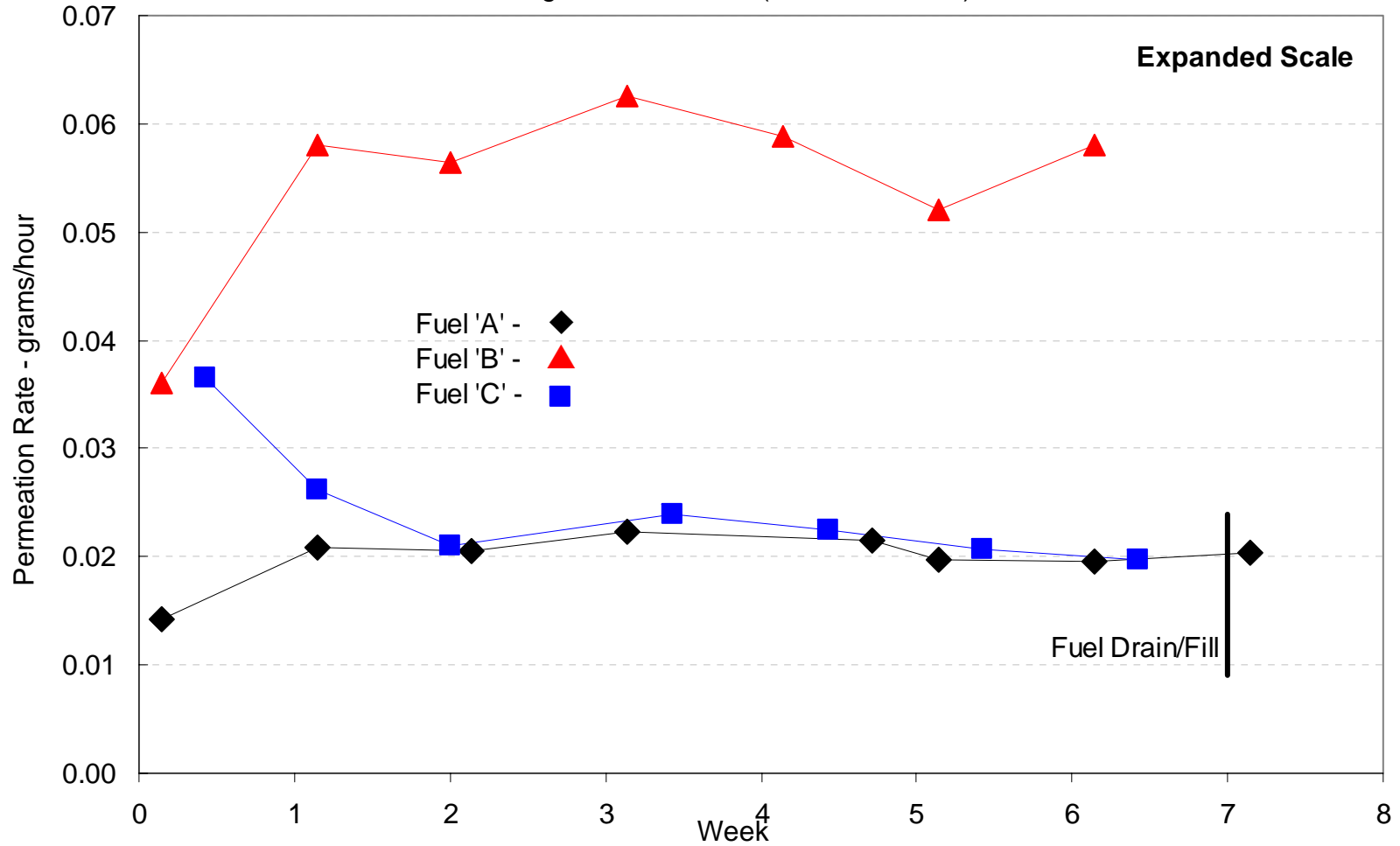
Rig #	Model Year	Vehicle Model
1	2001	Toyota Tacoma
2	2000	Honda Odyssey
3	1999	Toyota Corolla
4	1997	Dodge Caravan
5	1995	Ford Ranger
6	1993	Chevrolet Caprice
7	1991	Honda Accord
8	1989	Ford Taurus
9	1985	Nissan Sentra
10	1978	Oldsmobile Cutlass



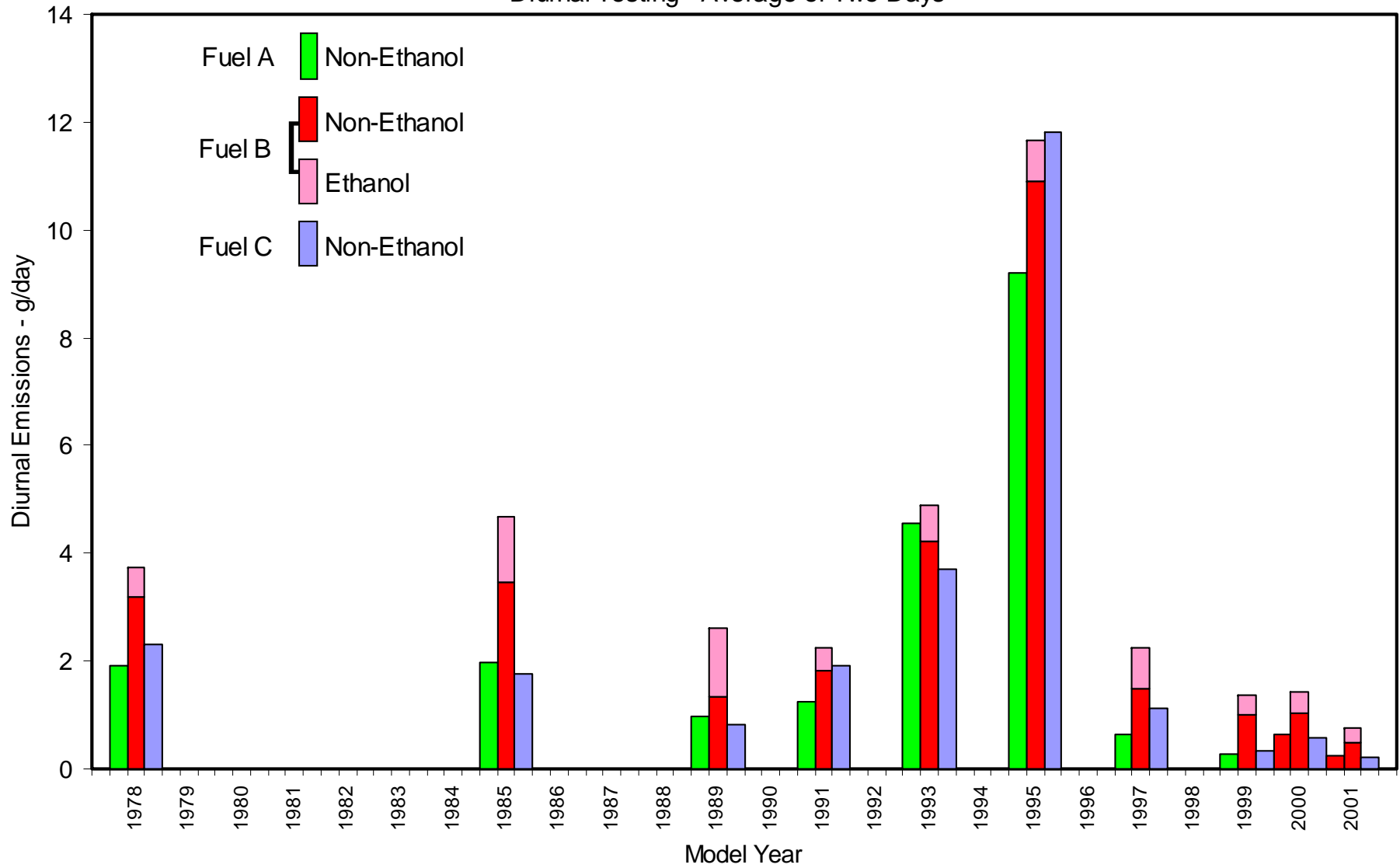
The 105°F Soak Room



Rig 01 Weekly Stabilization Testing Results
Average of Hours 2 & 3 (20 observations)



Non-Ethanol Increase in Ethanol Fuel Diurnal Testing - Average of Two Days



Summary – CRC E-65

1. Ethanol increases the permeation rate compared to MTBE, or no oxygenate
2. Non-ethanol permeation increased when ethanol fuel was tested.
3. Permeate specific reactivities from all three fuels were similar.
4. Permeation rate doubled for each 10°C increase
5. Newer vehicles, certified to enhanced standards, had lower permeation.

The Encore – E-65.3

- Repeat the program with 5 Newer Rigs
 - 2000 Honda Odyssey (Carry-over)
 - 2001 Toyota Tacoma (Carry-over)
 - 2004 LEV II (0.5 g/day) (New)
 - 2004 PZEV (New)
 - 2005 GM E85 FFV (Test on E0, E10 & E85 only)
- Five Fuels
 - E0
 - E6 20% Aromatics
 - E6 30% Aromatics
 - E10
 - E85 (FFV Vehicle Only)
- Complete by June 2006