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Thailand Experiences in Fuel Conversion and Alternative Fuels

□ The first step taken to mitigate air pollution in Thailand is **Fuel Quality Reformulation**

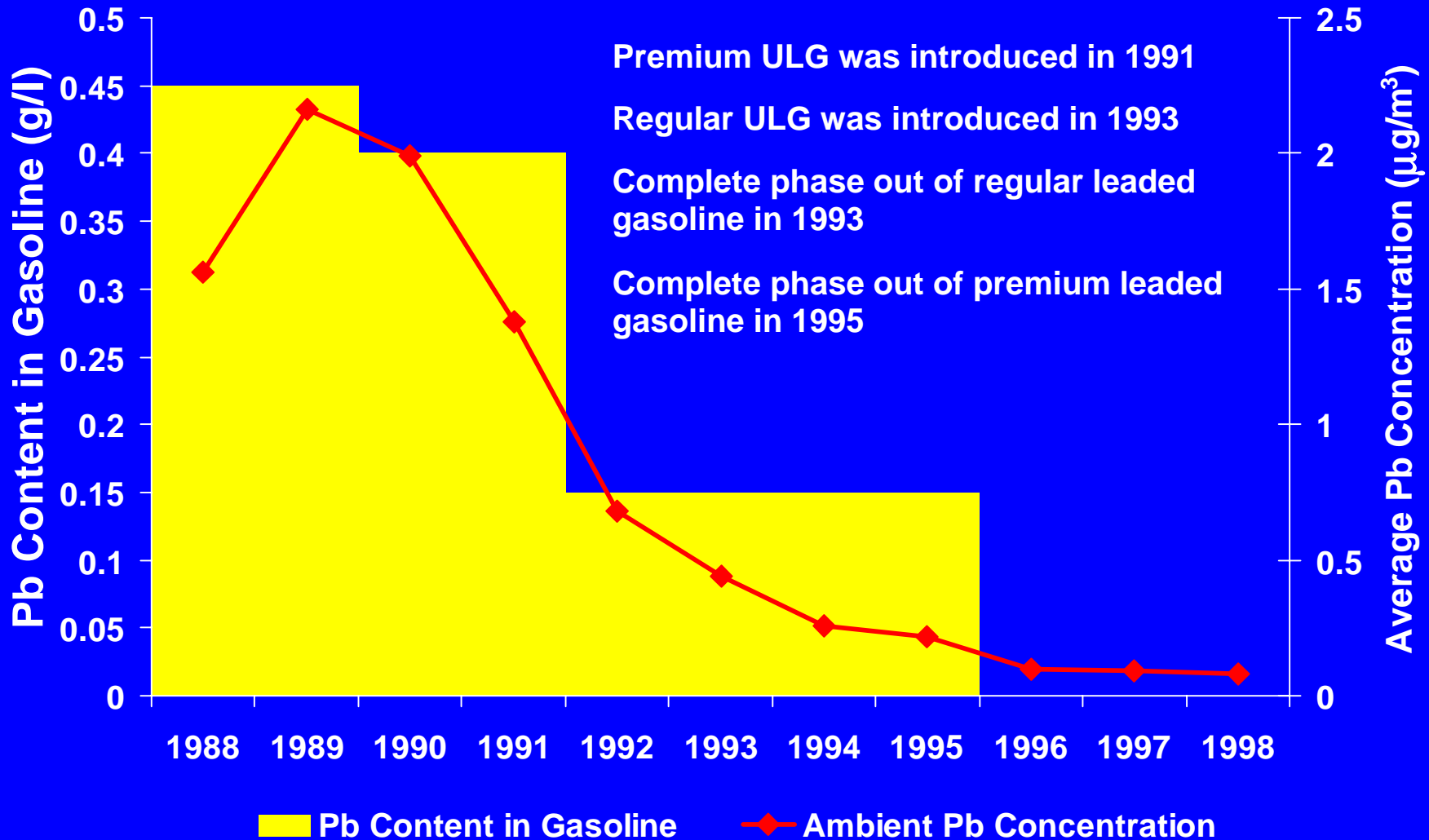
- ▣ **Gasoline**
 - Phasing-out lead
 - Oxygenated gasoline
 - Reducing C₆H₆ & Aromatics

- ▣ **Diesel**
 - Reducing distillation temperature
 - Reducing sulfur content

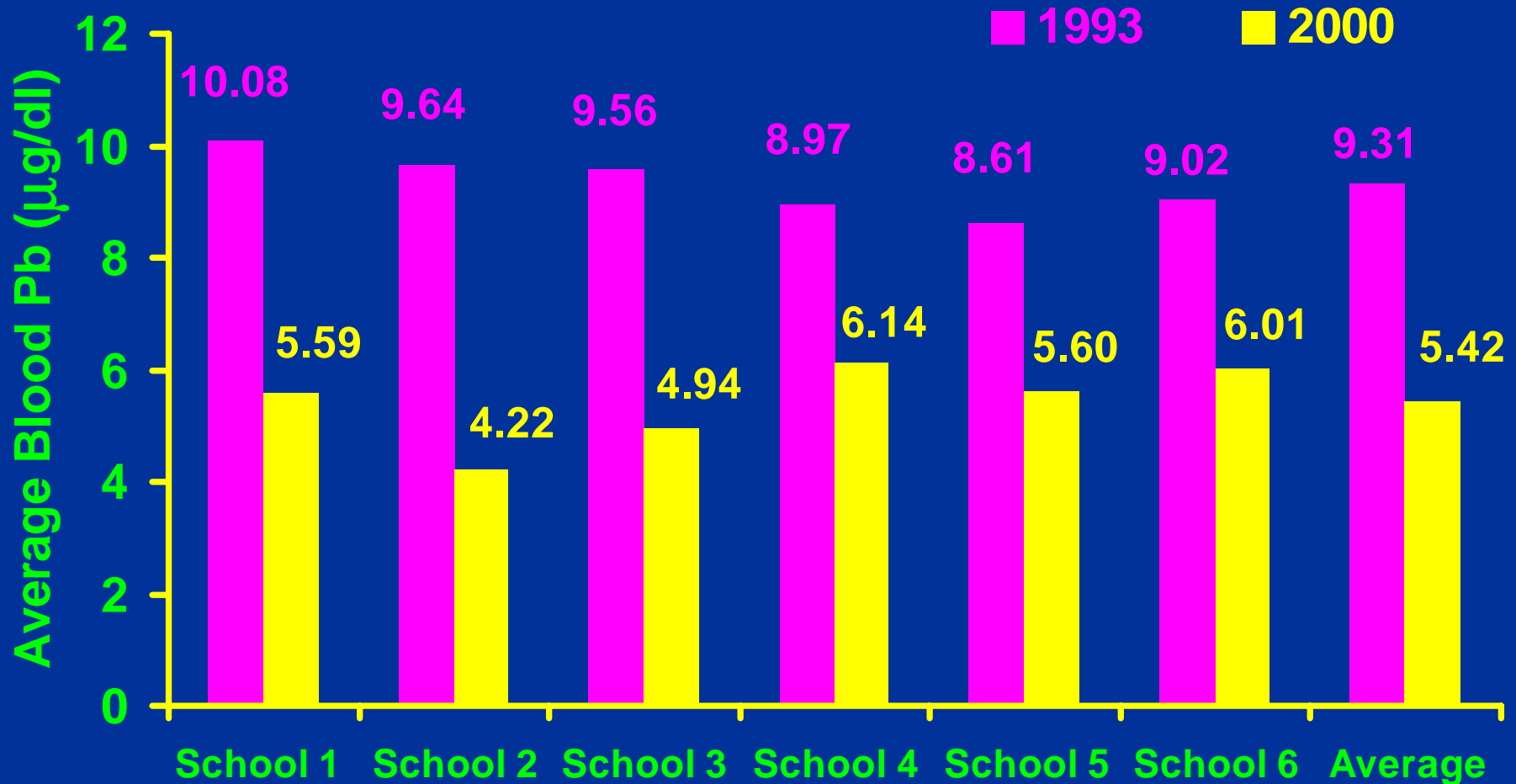
Thailand Experiences in Fuel Conversion and Alternative Fuels

- **With better quality of gasoline and diesel fuels, Thailand is able to introduce**
 - ▣ **Catalytic converter in new gasoline vehicles**
 - ▣ **Euro II heavy-duty trucks and buses**
- **As a result, ambient Pb, CO, and PM-10 concentrations have declined during the past few years**

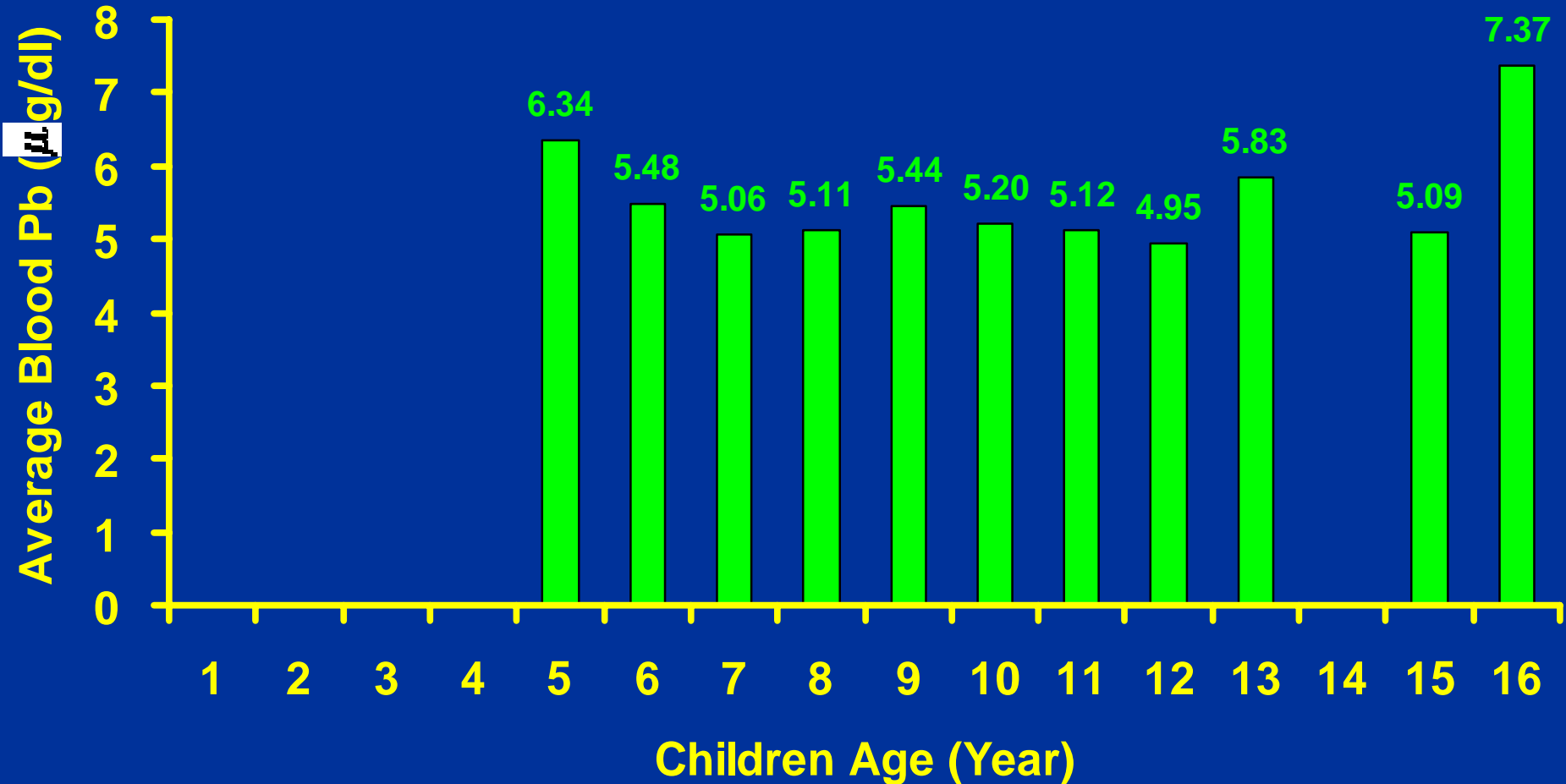
Ambient Pb Concentrations in Bangkok and Pb in Gasoline from 1988 - 1998



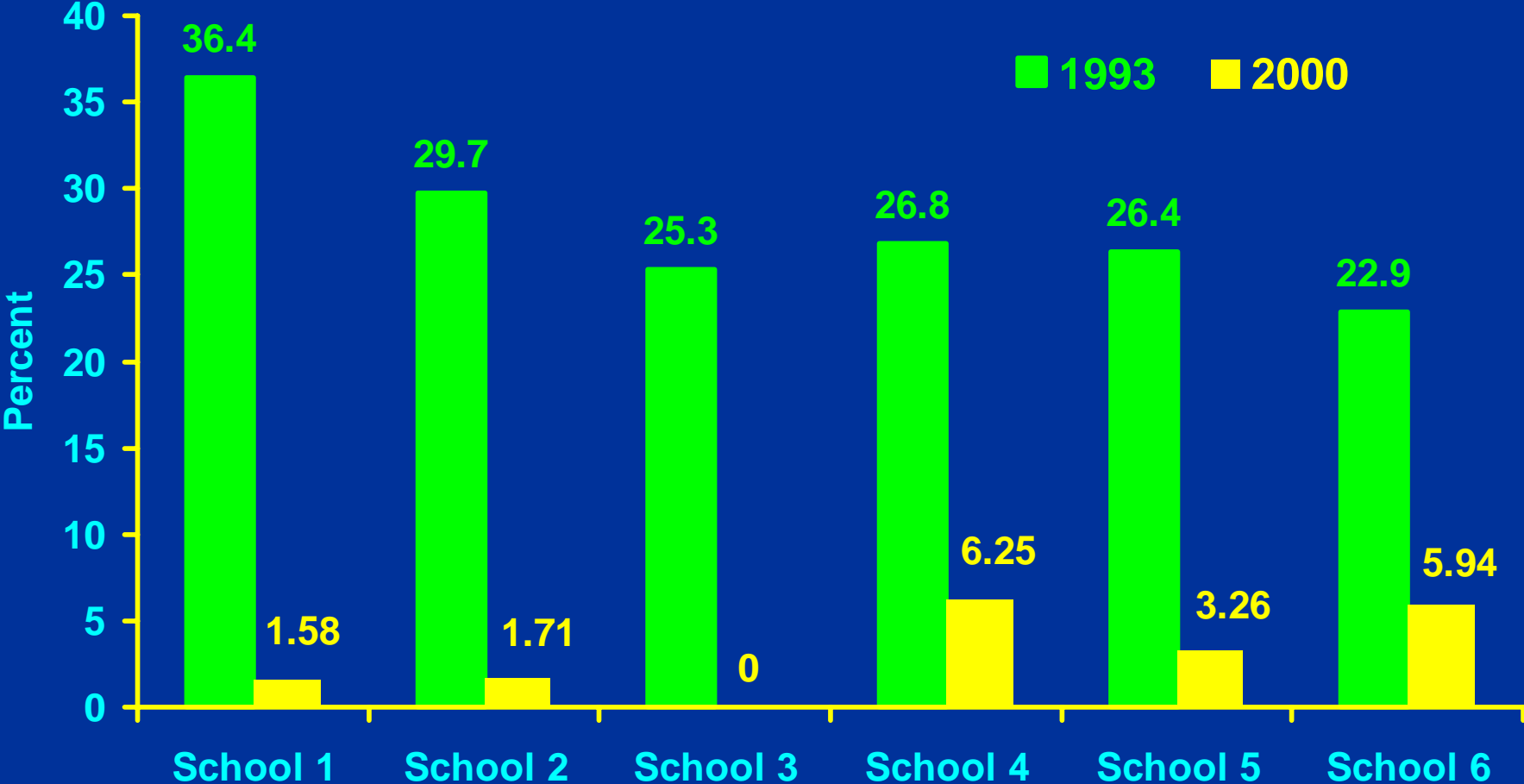
Comparison of Average Blood Pb Levels in Children at 6 Schools in Bangkok between 1993 and 2000



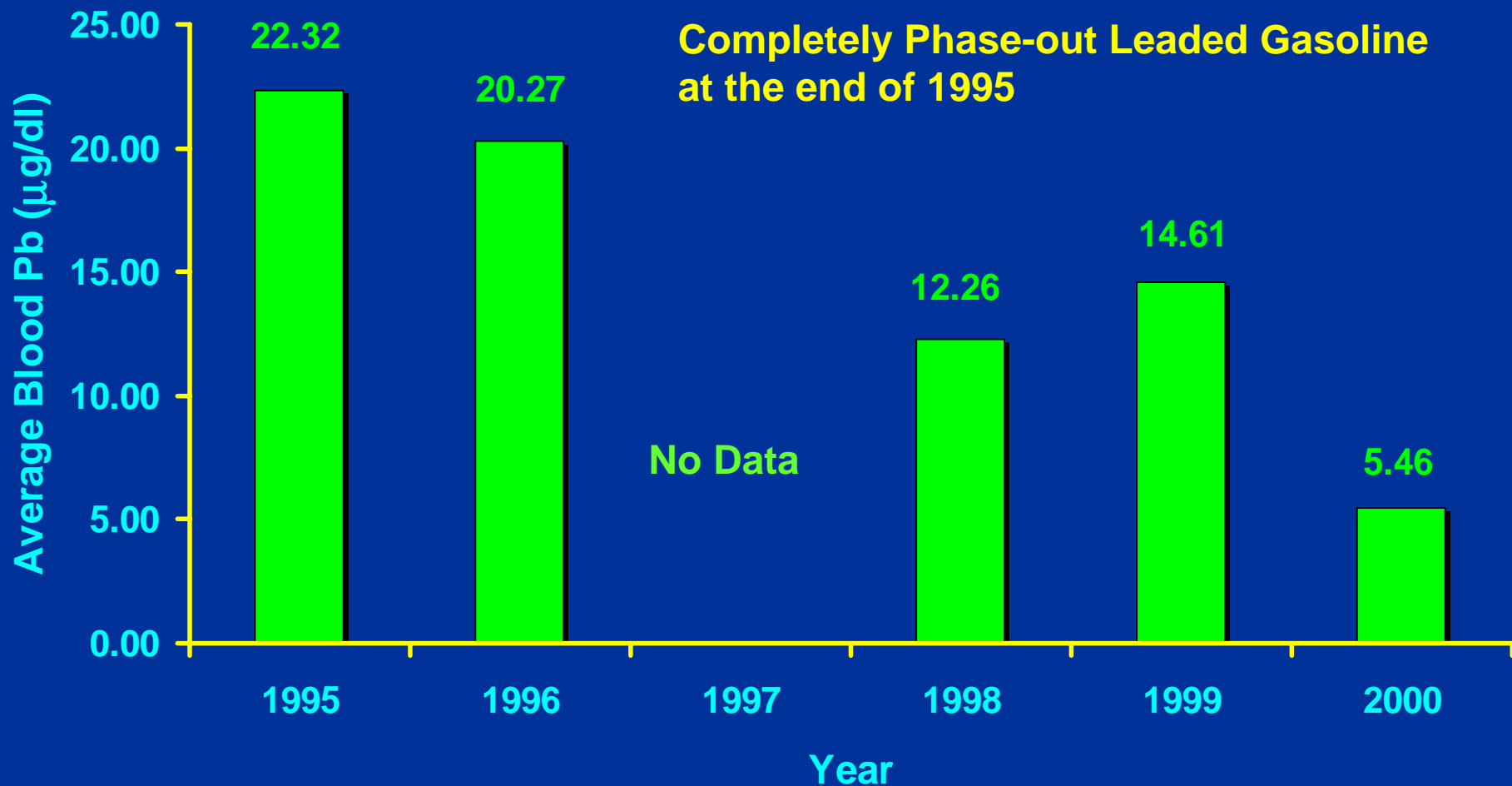
Average Blood Pb Levels in School Children by Age in 2000



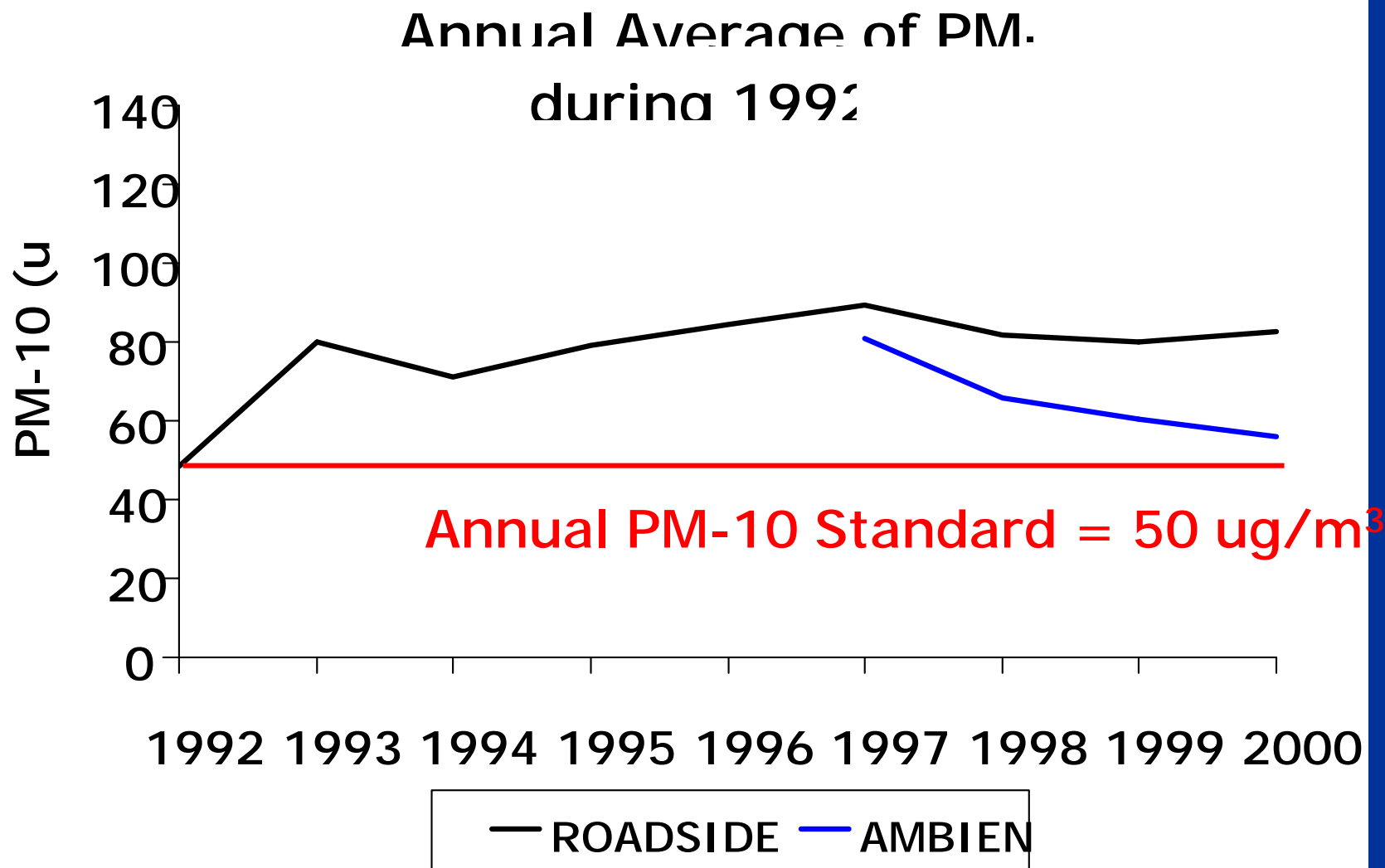
Percentage of School Children with Blood Pb Levels $\geq 10 \mu\text{g/dl}$



Average Blood Pb Levels in Traffic Policemen in Bangkok from 1995 - 2000

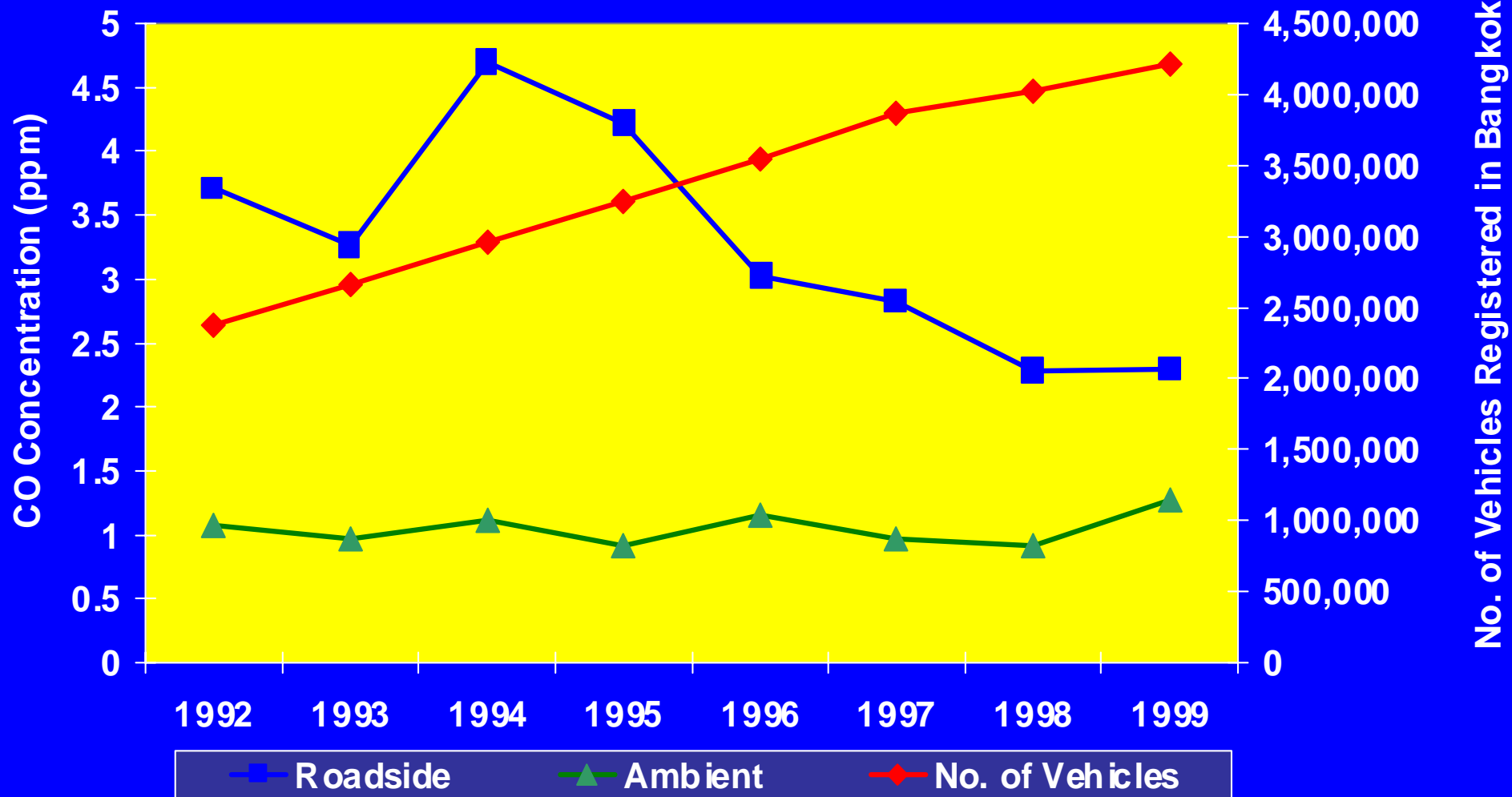


Thailand Experiences in Fuel Conversion and Alternative Fuels



Thailand Experiences in Fuel Conversion and Alternative Fuels

CO Concentrations in Bangkok from 1992-1999



Thailand Experiences in Fuel Conversion and Alternative Fuels

- Fuel quality specifications are currently being reviewed for the year 2005 and 2010
 - ☐ **Gasoline** - RVP, Sulfur, T50, T90, Benzene, Aromatics, Olefins, Oxygenates
 - ☐ **Diesel** - Sulfur, T90, Aromatics, Cetane Number

Scenario Ranges - Gasoline

<u>Property</u>	<u>Baseline</u>	<u>Range</u>
RVP	8.5 psi	7.0 - 8.7
Sulfur	175 ppm	50 - 120
Aromatics	39.6 vol%	25 - 35
T50	90°C	90 - 103
T90	156°C	150 - 168
Olefins	8.1 vol%	6.0 - 18.1
Oxygenates	0.83 wt%	0.0 - 1.90
Benzene	2.4 vol%	0.8 - 1.2

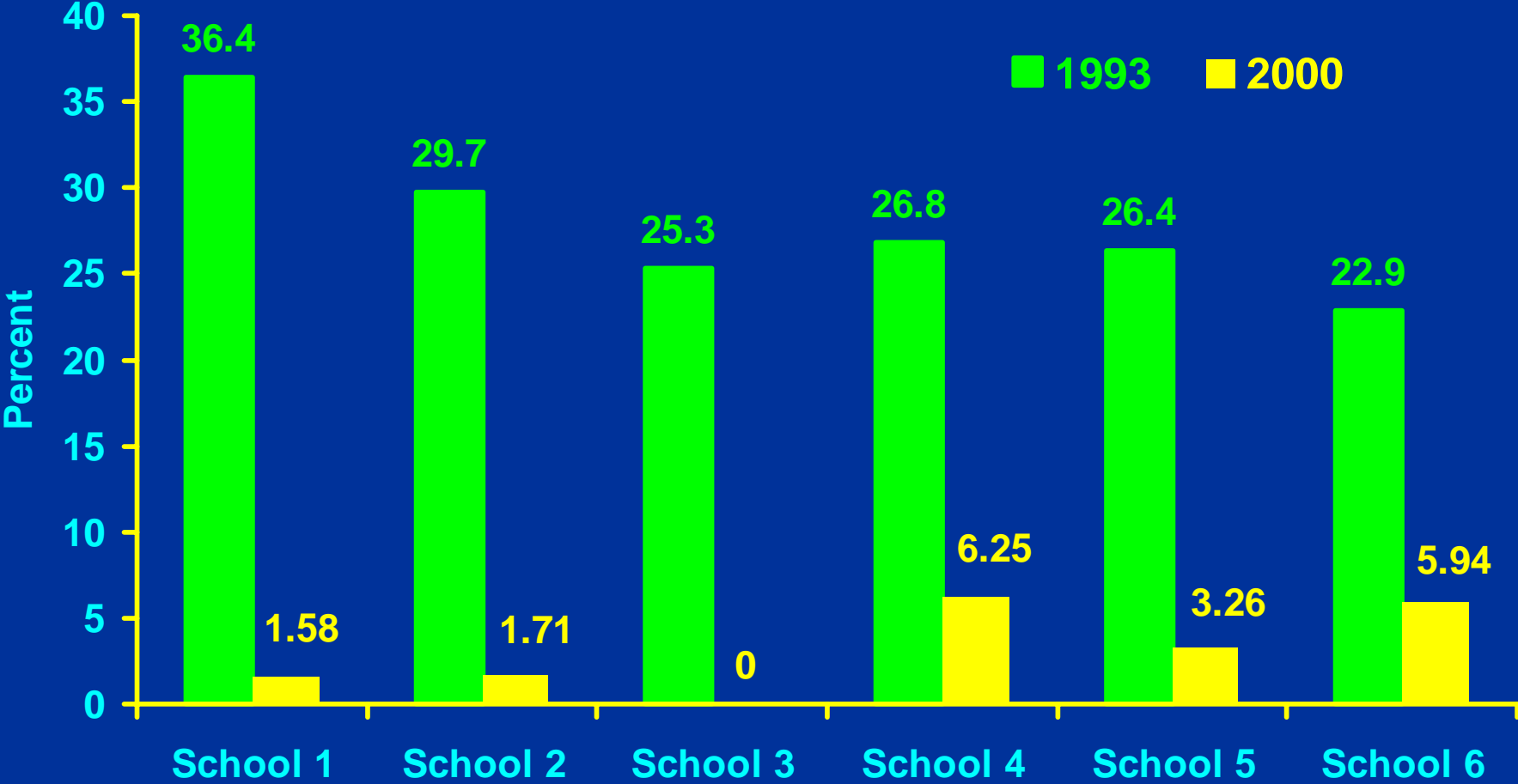
Scenario Ranges - Diesel

<u>Property</u>	<u>Baseline</u>	<u>Range</u>
Sulfur	367 ppm	30 - 200
Aromatics	28.1 vol%	10 - 28.1
Cetane Number	53	51 - 58
T90	354°C	330 - 360

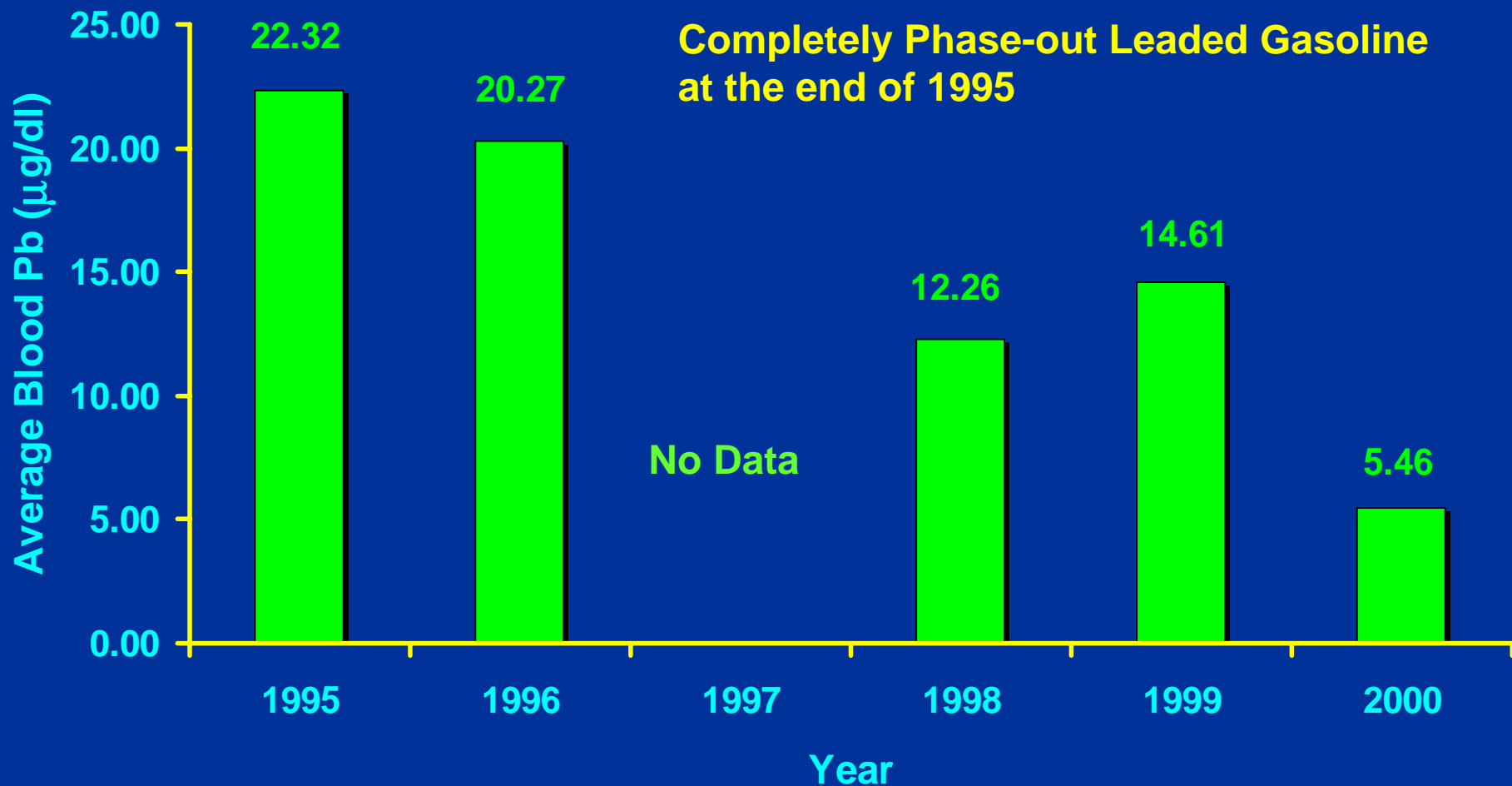
Alternative Fuels

- ❑ **LPG (Liquified Petroleum Gas)**
- ❑ **CNG (Compressed Natural Gas)**
- ❑ **Gasohol (Gasoline + Ethanol)**
- ❑ **Diesohol (Diesel + Ethanol)**
- ❑ **Biodiesel**
- ❑ **Electric**

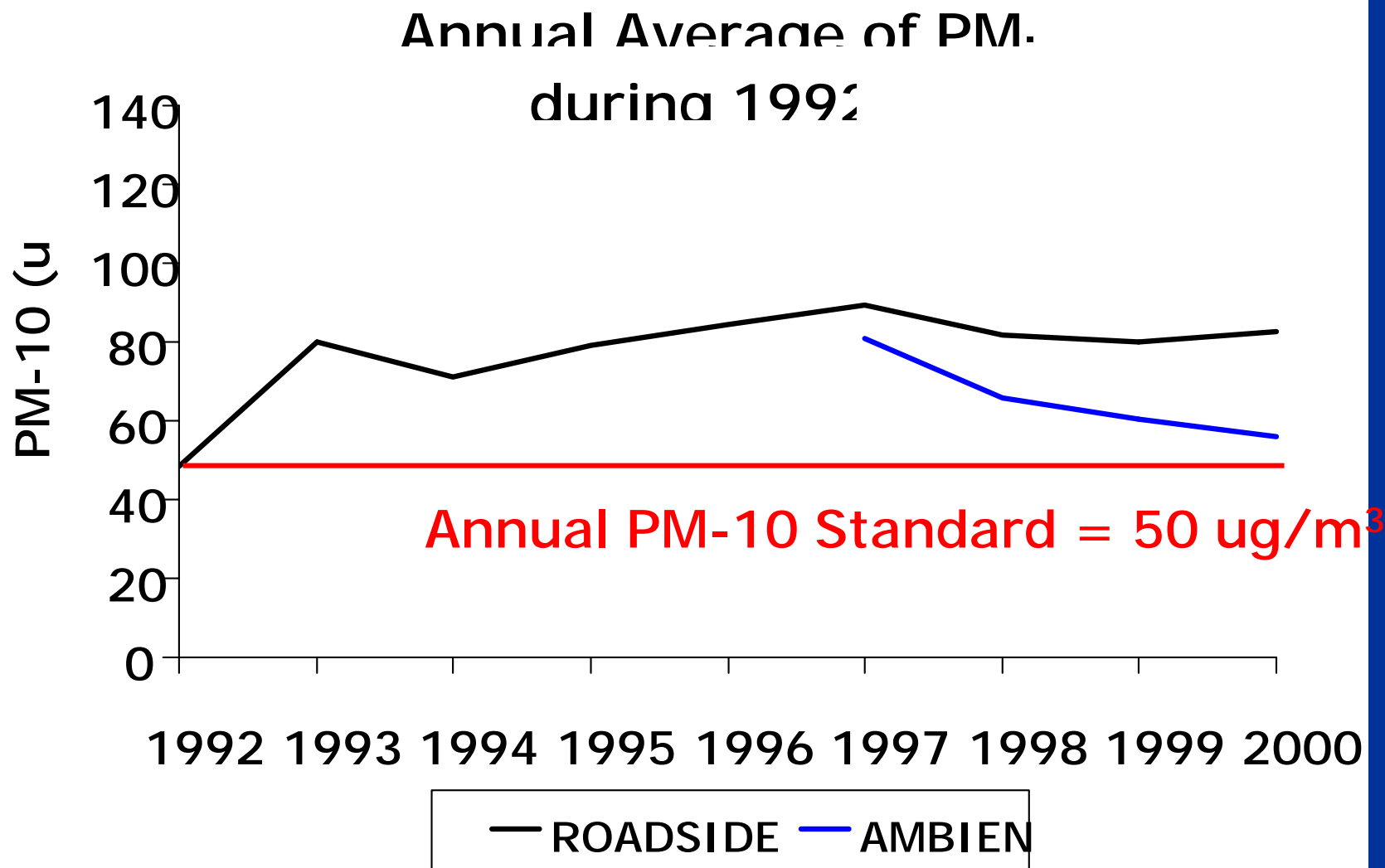
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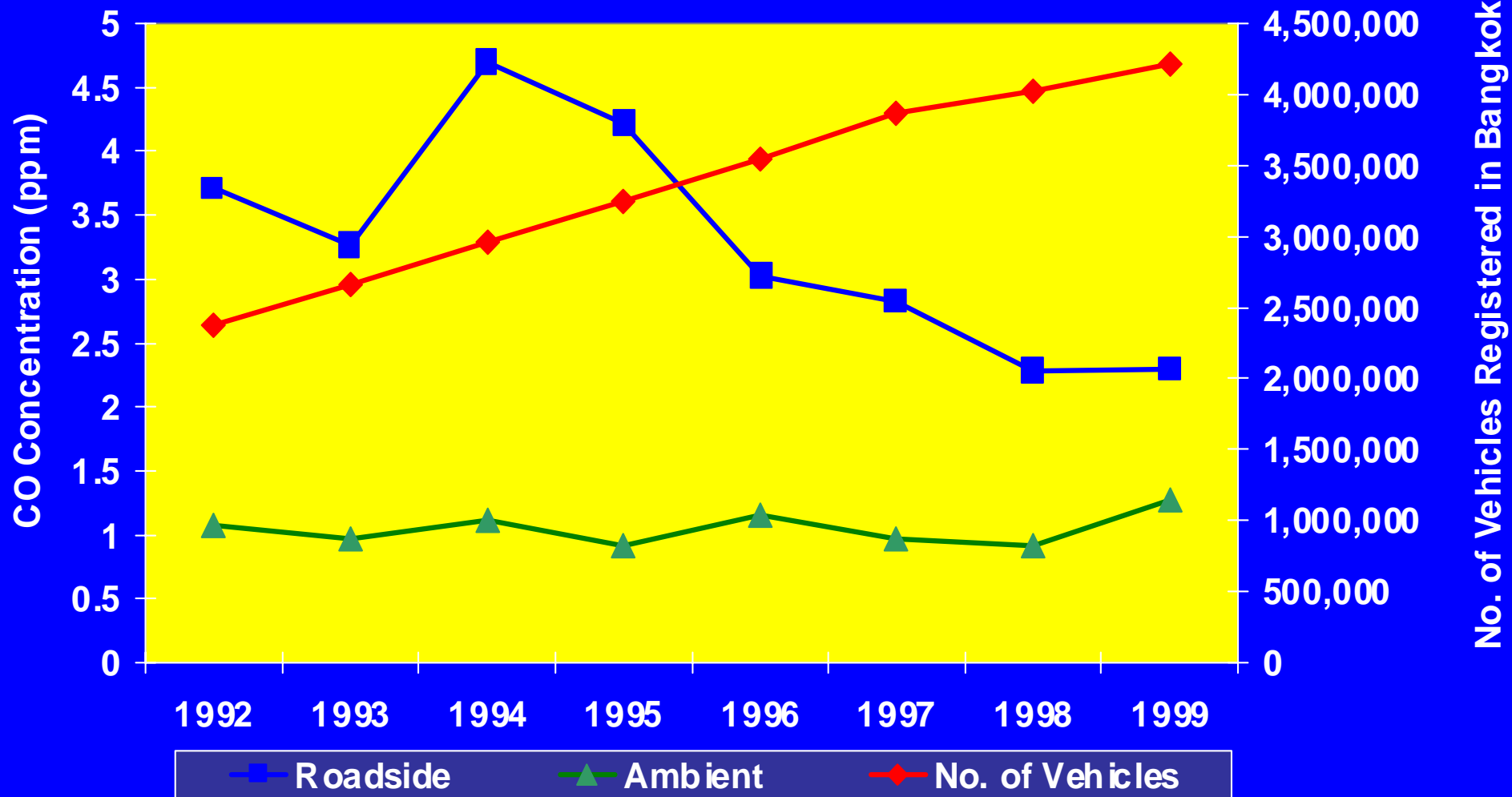


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LPG - Liquefied Petroleum Gas



- ⌘ Used in all 3-Wheelers (Tuk-Tuk) in BKK more than 20 years
- ⌘ Used in Taxi in BKK depending on gasoline price



LPG - Liquefied Petroleum Gas



⌘ LPG Refueling
Station in BKK



CNG - Compressed Natural Gas



⌘ 82 CNG Buses have
been used in BKK
since 1992

