



Improving Urban Air Quality Through Clean Fuels and Vehicles: The Experience of Sub-Saharan Africa and Global Trends



Jane Akumu

Addis Ababa, Ethiopia, 22 July 2008

Urbanization in SSA

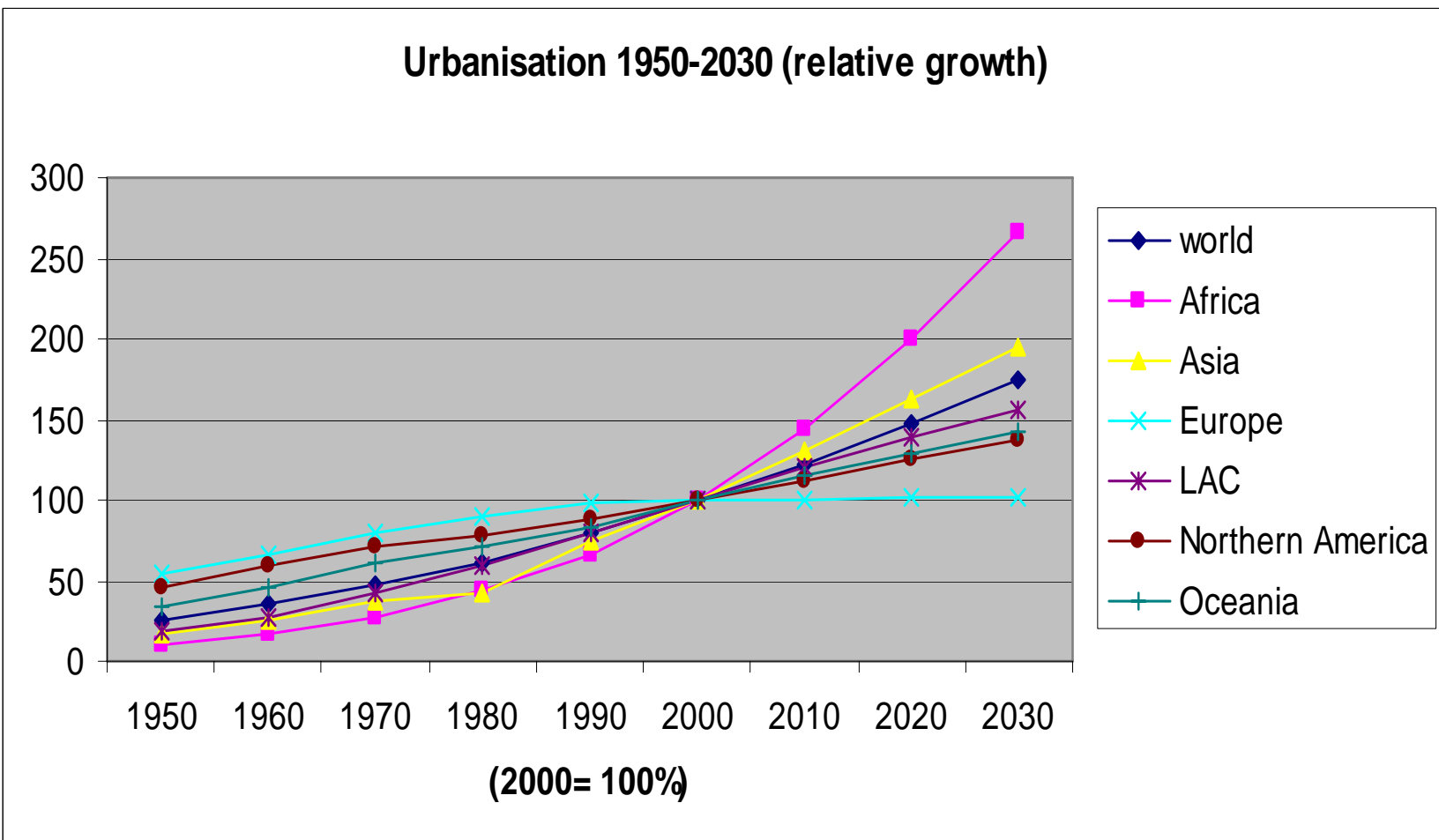


- SSA has highest annual urban growth rate - **4.58%**
- (UN-Habitat) Cities in Africa are **doubling 10 years**
- **Mega cities** - 2020, Lagos, projected largest city
- In **South Africa** respiratory infections from outdoor air pollution kill **2000 children annually**



Urbanization by Region

Urbanisation 1950-2030 (relative growth)

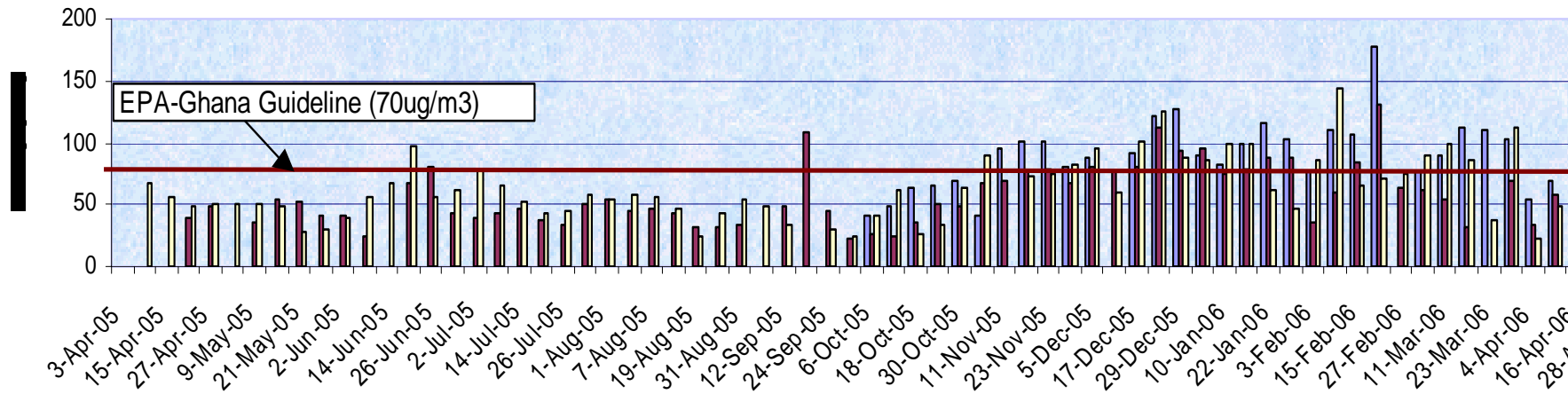


Major sources of ambient air pollution in Accra

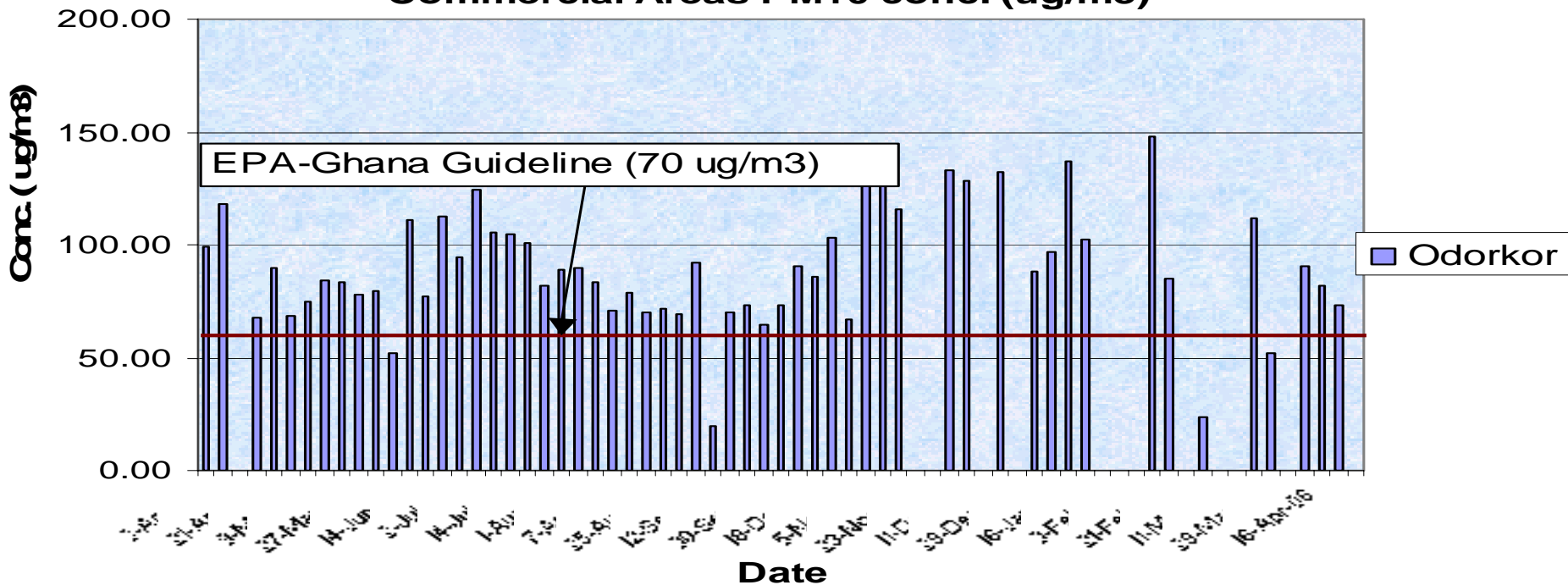


- Vehicular exhaust
- Industrial and mining sources
- Open burning of waste and other materials
- Road and wind blown dust
- *PM10 is the main pollution problem*

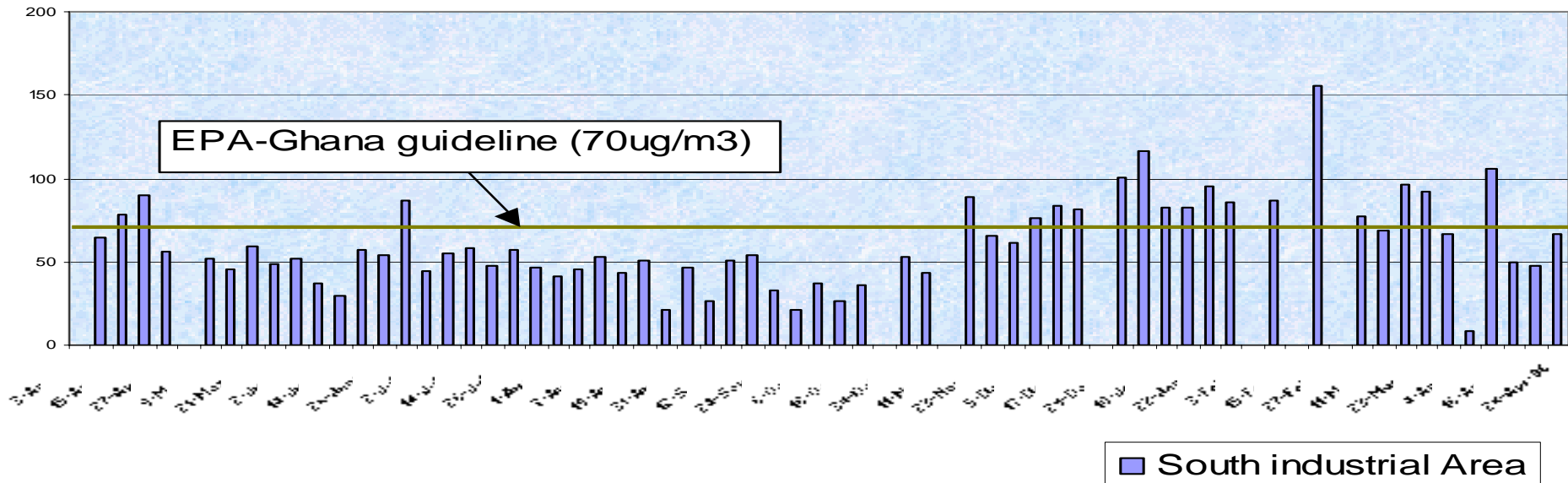
Residential areas PM10 conc. (ug/m3)



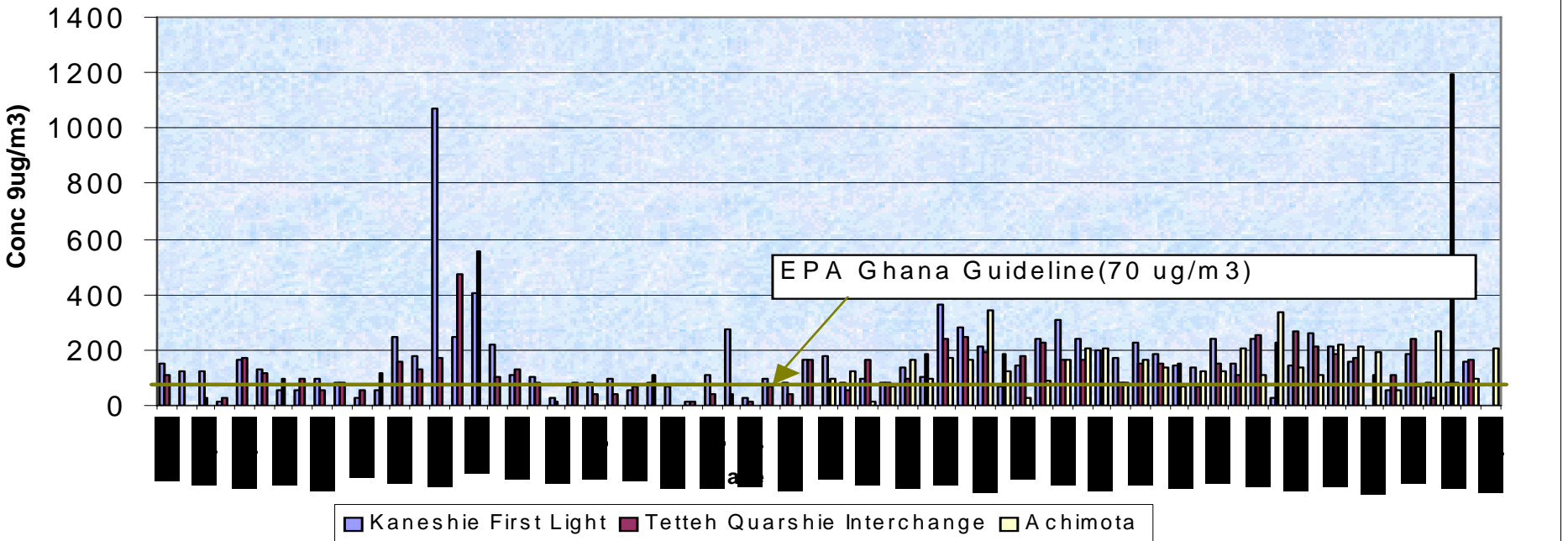
Commercial Areas PM10 conc. (ug/m3)



Industrial Area PM10 conc.(ug/m3)

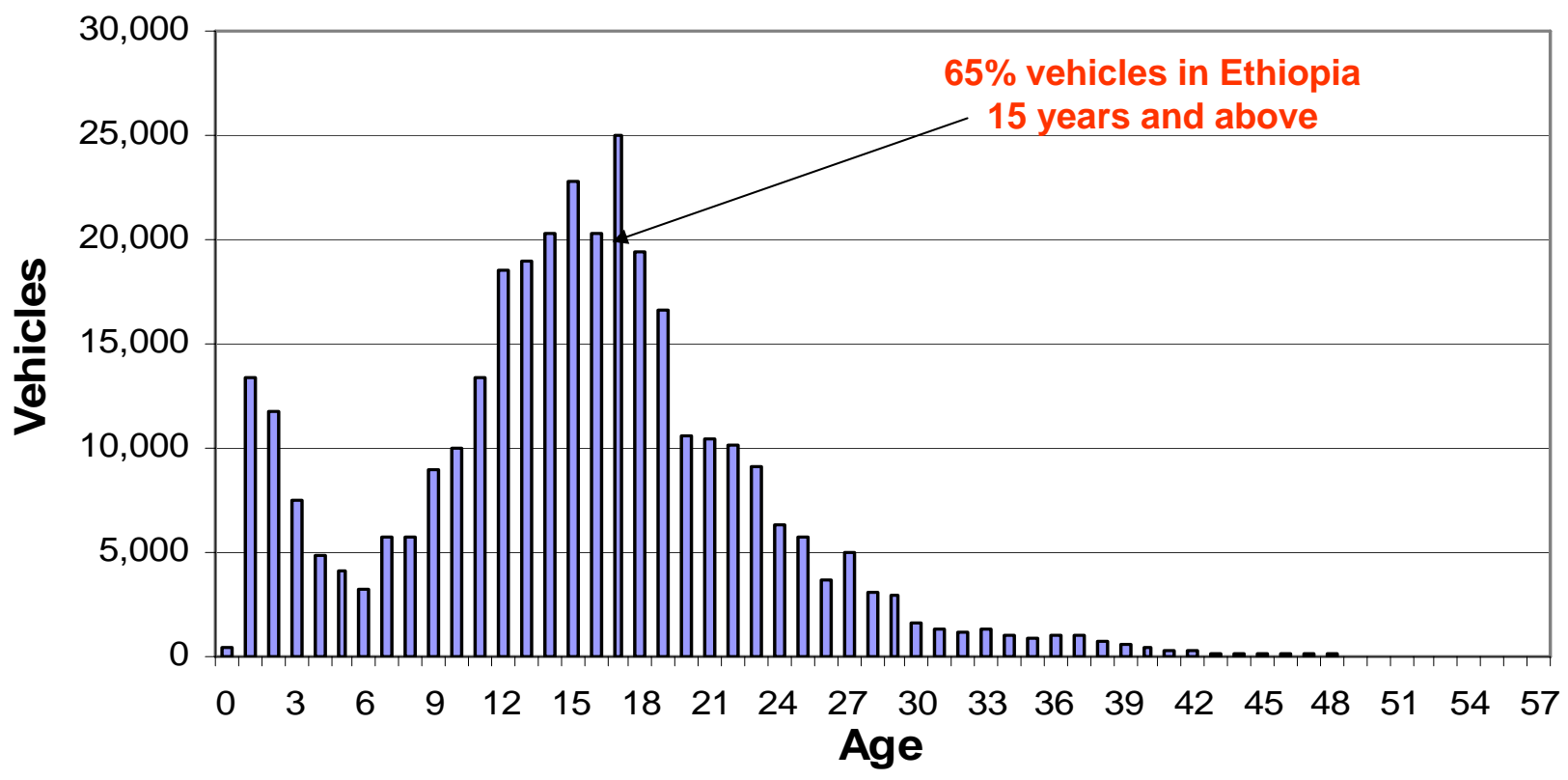


Roadside sites PM10 conc (ug/m3)





Vehicle Age: Tanzania Example



Vehicle age distribution in Tanzania.
Source: Tanzania Revenue Authority

Urbanization and Air Pollution



- Unleaded gasoline
- Sulphur phase down
- Clean technologies
- Clean vehicles
- Air quality monitoring
- Emission measurement

Partnership for Clean Fuels and Vehicles (PCFV)



- Was set up at the World Summit on Sustainable Development, **September 2002**
- Main objective is to address **urban air quality** in developing countries by promoting **clean fuels** and **vehicles**
- Comprises over **100 partners** from governments, industry, international organizations and civil society
- **Clearing-House** in UNEP Headquarters in Nairobi, Kenya



PCFV GOALS (2005)

- To reduce sulphur in vehicle fuels to **50 ppm or below** worldwide, concurrent with clean vehicles and clean vehicles technologies, with **roadmaps** and **timelines** developed **regionally** and **nationally**
- To phase out leaded gasoline by **end of 2008** worldwide to be followed by the global introduction of vehicles with **catalytic converters**

PCFV Action

Improve your children's IQ.

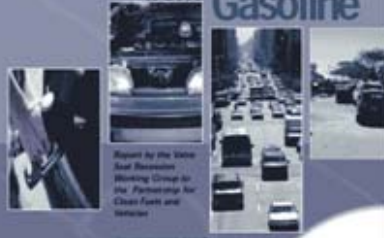


Switch to unleaded petrol.

Academic studies have shown that children of parents who use unleaded petrol have higher IQs than children of parents who use leaded petrol.

UNLEADED PETROL
SALES ARE UP 50% SINCE 2000

Eliminating Lead from Gasoline



Report by the International Lead-Free Gasoline Working Group to the Partnership for Clean Fuels and Vehicles

Support the Lead-Free Gasoline

Partnership for Clean Fuels and Vehicles



partnership for clean fuels and vehicles

Home | About the Partnership | Our Partners | News | Publications | Events | Science Stories | Our Objectives | Media | What's New | Site Map | Contact Us

NEWS: Panel of Partners to present at SAE World Congress

partnership activities

the partnership

The Partnership for Clean Fuels and Vehicles was established in 1997 to support the development of a global network of scientists and engineers to address the challenges of clean fuels and vehicles.

partnership news

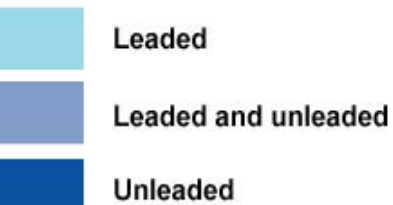
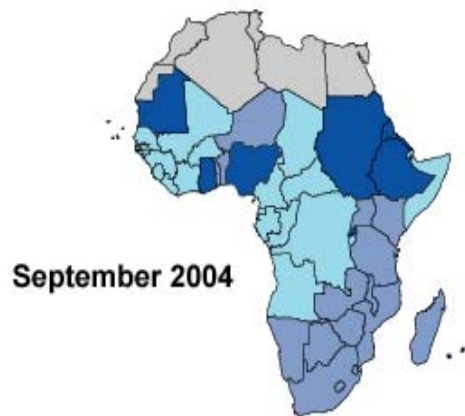
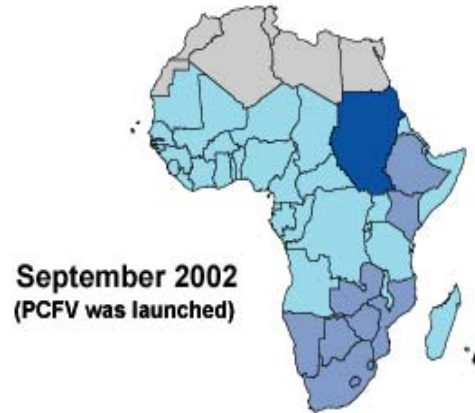
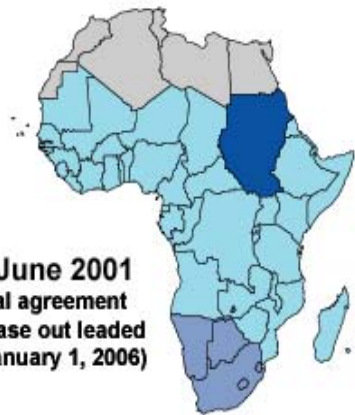
Michael Ward, Associate PCFV Partner, will present at the SAE World Congress in Washington DC in October 2002 to highlight the role of the Partnership in addressing the challenges of clean fuels and vehicles.

Panel of Partners to present at the SAE World Congress



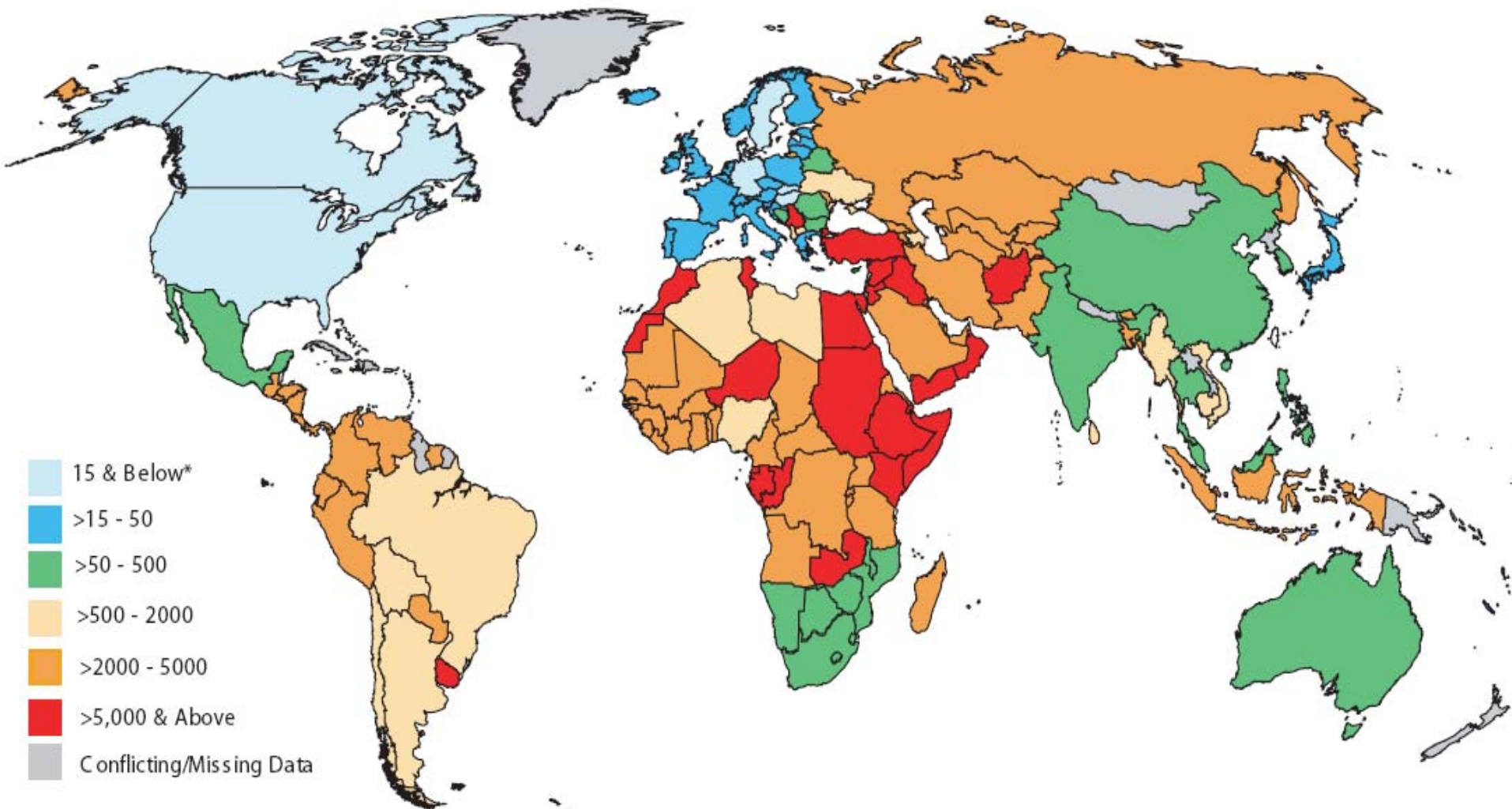


Progress of leaded petrol phase out in sub-Saharan Africa





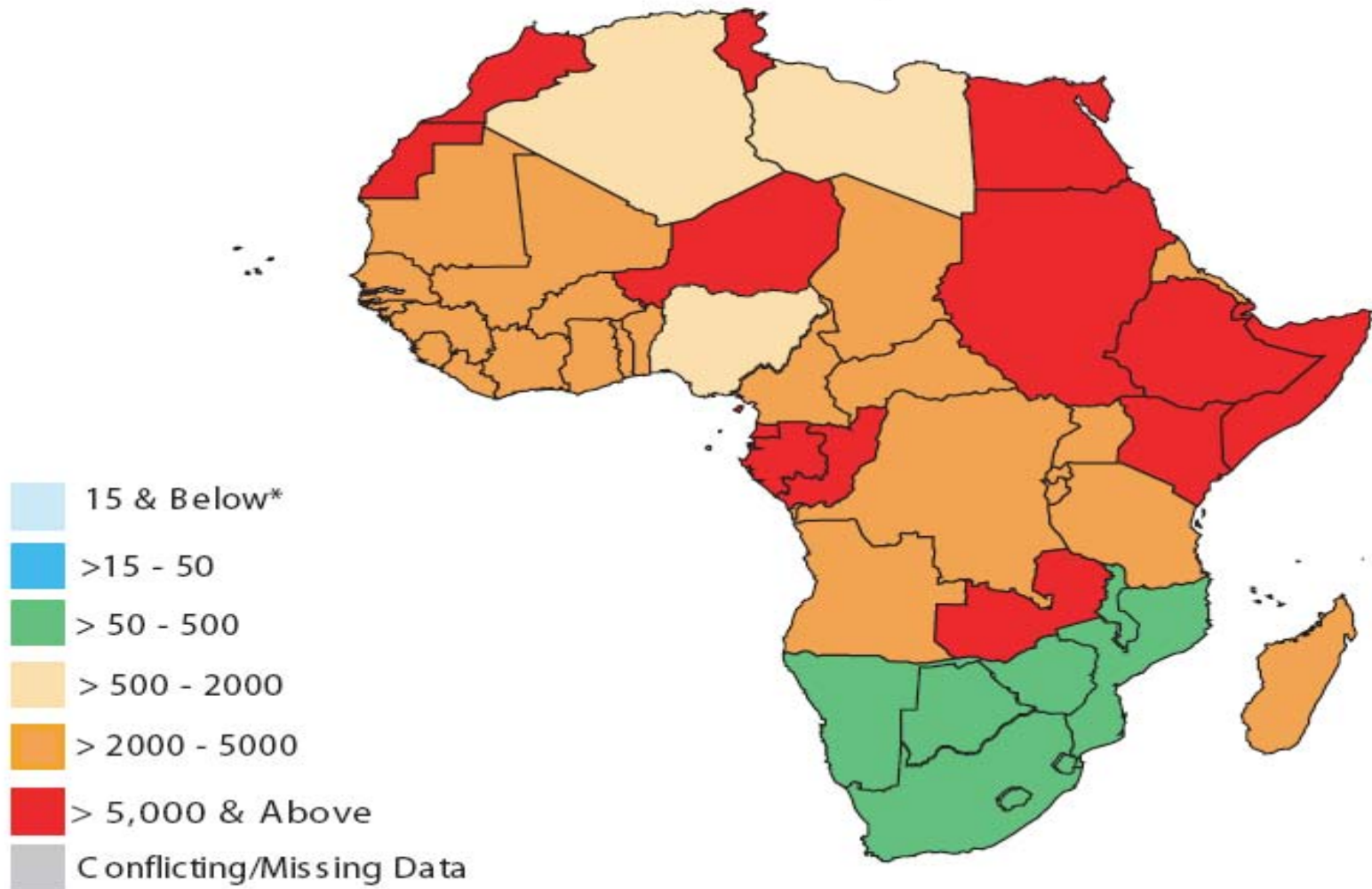
Diesel Fuel Sulphur Levels: Global Status



* Information in parts per million (ppm)

Sulphur levels are maximum allowable as of May 2008. For additional details and comments per country, visit www.unep.org/pcfv.

Diesel Fuel Sulphur Levels: Africa Status May 2008



* Information in parts per million (ppm)

May 2008



1970 Car Vs. a 2007 Car in the US

	1970's Vehicle	1990's Vehicle	2007 Vehicle
CO2	700 gpm*	375 gpm	375 gpm <small>EU = 130 By 2012</small>
VOC	7.5 gpm	1.5 gpm	0.09 gpm
CO	88 gpm	19 gpm	4.2 gpm
NOx	3.5 gpm	1.6 gpm	0.07 gpm
Lead	0.22 gpm	0.00003 gpm	0.00003 gpm
Evap	11 gpm	0.9 gpm	0.03 gpm
In-use FE	12.7 mpg	23.7 mpg	23.7 mpg
Useful Life	50,000 miles	100,000 miles	120,000 miles**

* gpm = grams per mile

* 120,000 miles = ~ 193,000 km

Options for countries



- Country analysis of vehicle fleet
 - Fleet: make-up/composition and size
 - Import source: current and future (age)
 - Highest emission sources (emission testing, maintenance and inspection)
- Need for an integrated approach combining clean fuels and clean vehicles to improve air quality
- Decide optimal level of lowering sulphur levels



Country Experiences: The European Union (EU) Fuels

Year	Standard	Specification
1994	Euro 1	Maximum sulphur limit of 0.2% (wt.) = 2,000 ppm for all gas oils, including diesel fuel. Minimum cetane number was 49.
1996	Euro 2	A maximum sulphur limit of 0.05% (wt.) = 500 ppm for diesel fuel.
2000	Euro 3	A maximum sulphur limit of 0.035% (wt.) = 350 ppm and cetane number of 51 for diesel fuel.
2005	Euro 4	A maximum sulphur limit of 0.005% (wt.) = 50 ppm for diesel fuel. “Sulphur-free” 10 ppm sulphur diesel fuel must be available for highway vehicles.
2009	Euro 5	A maximum sulphur limit of 0.001% (wt.) = 10 ppm (“sulphur-free”) for diesel fuel for highway and nonroad vehicles

EU Emission Standards for Passenger Cars, g/km

Tier	Date	CO	HC	HC+NO _x	NO _x	PM
Diesel						
Euro 1	1992	2.72	-	0.97	-	0.14
Euro 2	1996	1.0	-	0.7	-	0.08
Euro 2	1996	1.0	-	0.9	-	0.10
Euro 3	2000	0.64	-	0.56	0.50	0.05
Euro 4	2005	0.50	-	0.30	0.25	0.025
Euro 5	2009	0.50	-	0.23	0.18	0.005
Euro 6	2014	0.50	-	0.17	0.08	0.005
Petrol (Gasoline)						
Euro 1	1992	2.72	-	0.97	-	-
Euro 2	1996	2.2	-	0.5	-	-
Euro 3	2000	2.30	0.20	-	0.15	-
Euro 4	2005	1.0	0.10	-	0.08	-
Euro 5	2009	1.0	0.10	-	0.06	0.005
Euro 6	2014	1.0	0.10	-	0.06	0.005





INDIA - Fuels

Year	Specifications	Location
1995	Cetane number: 45; Sulfur:1% (10,000 ppm)	
1996	Sulfur: 0.5% (5,000 ppm)	Delhi + selected cities
1998	Sulfur: 0.25% (2,500 ppm)	Delhi
1999	Sulfur: 0.05% (500 ppm)	Delhi, limited supply
2000	Cetane number: 48; Sulfur: 0.25%	Nationwide
2001	Sulfur: 0.05%	Delhi + selected cities
2005	Sulfur: 350 ppm Euro 3;	selected areas
2010	Sulfur: 350 ppm Euro 3;	nationwide
2010	Sulfur: 50 ppm Euro 4	selected areas





INDIA - Emission Standards

Vehicle category	Year	Benchmark
Indian Emission Standards (4-Wheel Vehicles)	2000 2001 2005 2010	Euro 1 Euro 2 Euro 3 Euro 4
Emission Standards for Diesel Truck and Bus Engines, g/kWh (Gross Vehicle Weight (GVW) > 3,500 kg)	2000 2005 2010	Euro 1 Euro 2 Euro 3
Emission Standards for Light-Duty Diesel Vehicles, g/km (GVW ≤ 3,500 kg)	1992 1996 2000 2005 2010	Local standards Local standards Local standards Euro 2 Euro 3
Emission Standards for Gasoline Vehicles (GVW ≤ 3,500 kg), g/km (GVW ≤ 3,500 kg)	1991 1996 1998 2000 2005	Local standards Local standards Local standards Euro 1 Euro 2
Emission Standards for 3-Wheel Gasoline Vehicles, g/km	1991 1996 2000	Local standards Local standards Local standards
Emission Standards for 2-Wheel Gasoline Vehicles, g/km	1991 1996 2000	Local standards Local standards Local standards





BRAZIL - Fuels

Year	Resolution	On-road Diesel Sulphur Specification
December 2001	ANP Resolution 310/2001	Metropolitan: 2000ppm Interior: 3500ppm
December 2005	ANP Resolution 12/2005	Metropolitan: 500ppm
July 2006	ANP Resolution 15/2006	Metropolitan: 500ppm Interior: 2000ppm
2009	Standards to correspond to Euro 4	Metropolitan: 50ppm Interior: 500ppm



BRAZIL - Emission Standards

Vehicle category	Year	Benchmark	Country Standard
Diesel-Fueled Trucks and Buses	1993-2000	Euro 0/2 standards (Conama 8/93)	
Passenger Vehicles (FTP-75; Durability: 80,000 km/5 years)	2006-2007	Euro 3/4 standards (Resolution 315)	PROCONVE L-4 PROCONVE L-5
Light Commercial Vehicles (FTP-75; Durability: 80,000 km/5 years) (>1700 kg and ≤1700 kg)	2007-2009	Euro 3/4 standards (Resolution 315)	PROCONVE L-4 PROCONVE L-5
Heavy Duty Diesel Engines (Durability: 160,000 km/5 years)	2006-2009	Euro 3/4 standards (Resolution 315)	PROCONVE P-5 PROCONVE P-6

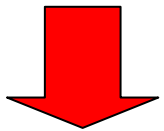


South Africa - Fuels

Year	Sulphur levels (parts per million)
2005	0.3% = 3,000 ppm
2006	0.05% = 500 ppm nationally 0.005% = 50 ppm major towns
Proposed standard (maybe 2013)	0.005% = 50 ppm nationally
2007	Emissions for new vehicle Euro 2

DIESEL VEHICLE EMISSION TESTING (Cape Town)

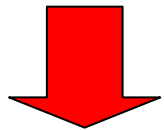
failure rate
17% - 2000



7.2% - 2003



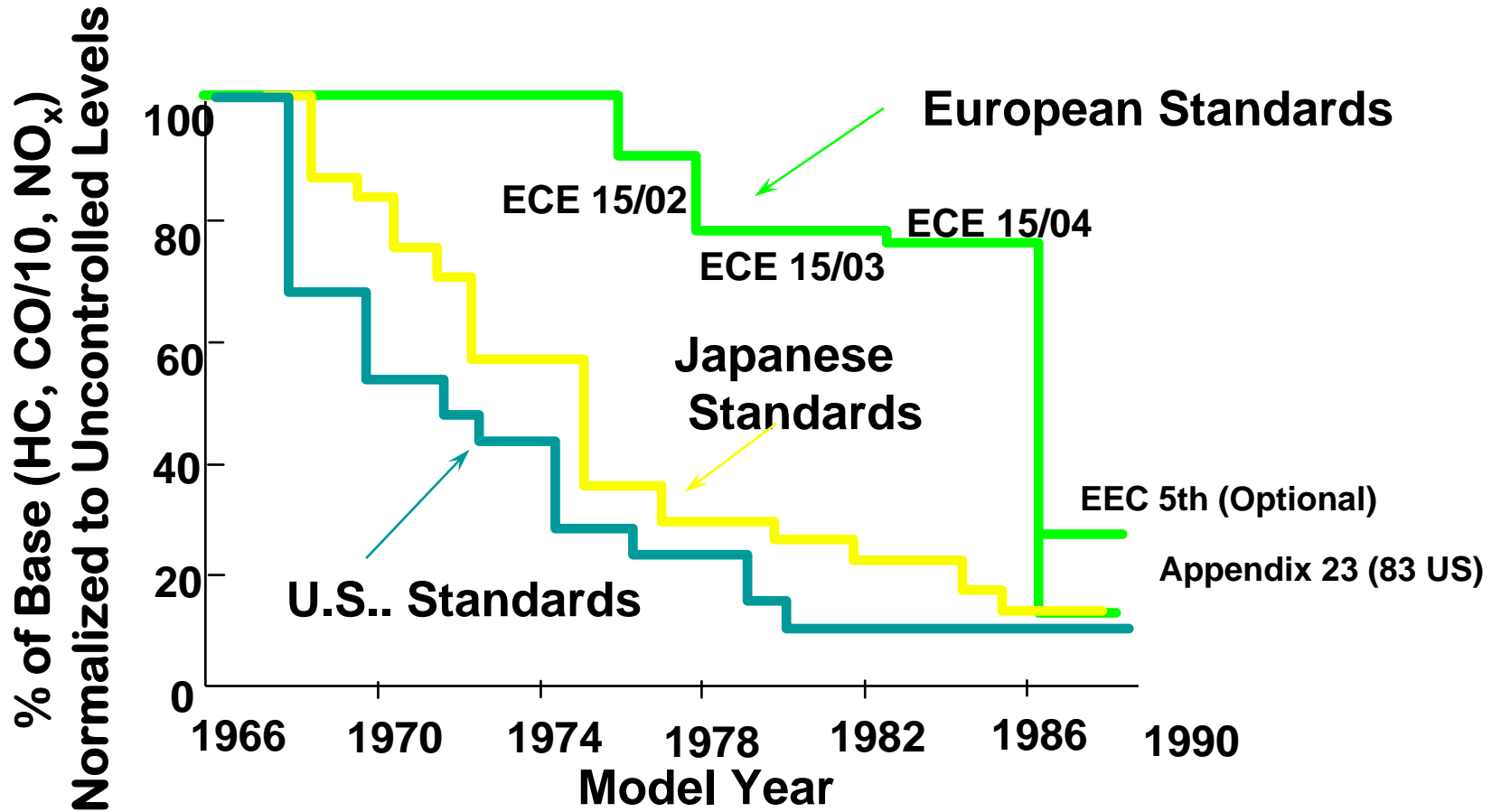
1.8% - 2005



1.07% - 2006



International Emission Standards



Availability of low sulphur fuels

- ❑ Globally refining countries are moving to ultra low sulphur levels – 10ppm and 15ppm
- ❑ In Africa, South Africa is advanced and some countries in North Africa – Morocco
- ❑ Sub-Saharan Africa, a refinery and health study is just starting under ARA/World Bank that will review the upgrading options and benefits of low sulphur fuels





Recommendations

- To lower sulphur levels in diesel fuels to at least **500ppm** in the short term
- Target **50ppm** as a long term goal and combine with vehicles for max benefits
- Import vehicles that are fitted with catalytic converters
- Review vehicle importation age and emissions
- Regulations key in determining current and future standards





Next steps

Better Air Quality in SSA Cities



Challenges in developing an air quality management strategy

- Low monitoring and assessment capacity
- Lack of standardized emission inventory at urban and regional levels
- poor modeling, and
- Lack of harmonized monitoring procedures



BAQ Proposed Solutions



- **Re-packaging** of air quality information to bring urgency of the issue to policy makers and public
- Link air quality to broader **economic growth** and **health issues**
- Develop **action plans** and **pilot projects**, including a **communication strategy**, at sub-regional level

Ministerial BAQ Recommendations



At the conference Ministers identifies **5 key areas** for intervention:

- **Transport** sector (NMT and public transport)
- **Industrial** and **Mining** emissions
- **Waste** management
- Clean **Fuels** and **Vehicles**
- Air Quality **Monitoring**

Next steps on BAQ



- To organise **sub-regional workshops** for Southern Africa (March 2008), Eastern Africa (October 2008) Central and Western Africa (early 2009)
- Follow-up the recommendations at **national** level