Why phase-out lead ?

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Urban air pollution a key issue

- WHO estimates more than 1 billion people exposed to outdoor air pollution exceeding maximum recommended levels
- Up to 1 million premature deaths, up to 1 million pre-native deaths
- Local and global effects (climate change)
- Cost of urban air pollution estimated to be 2% of GDP, in developed countries and more than 5% in developing countries
- Vehicle emissions largest source of air pollution in developing countries (up to 90%)

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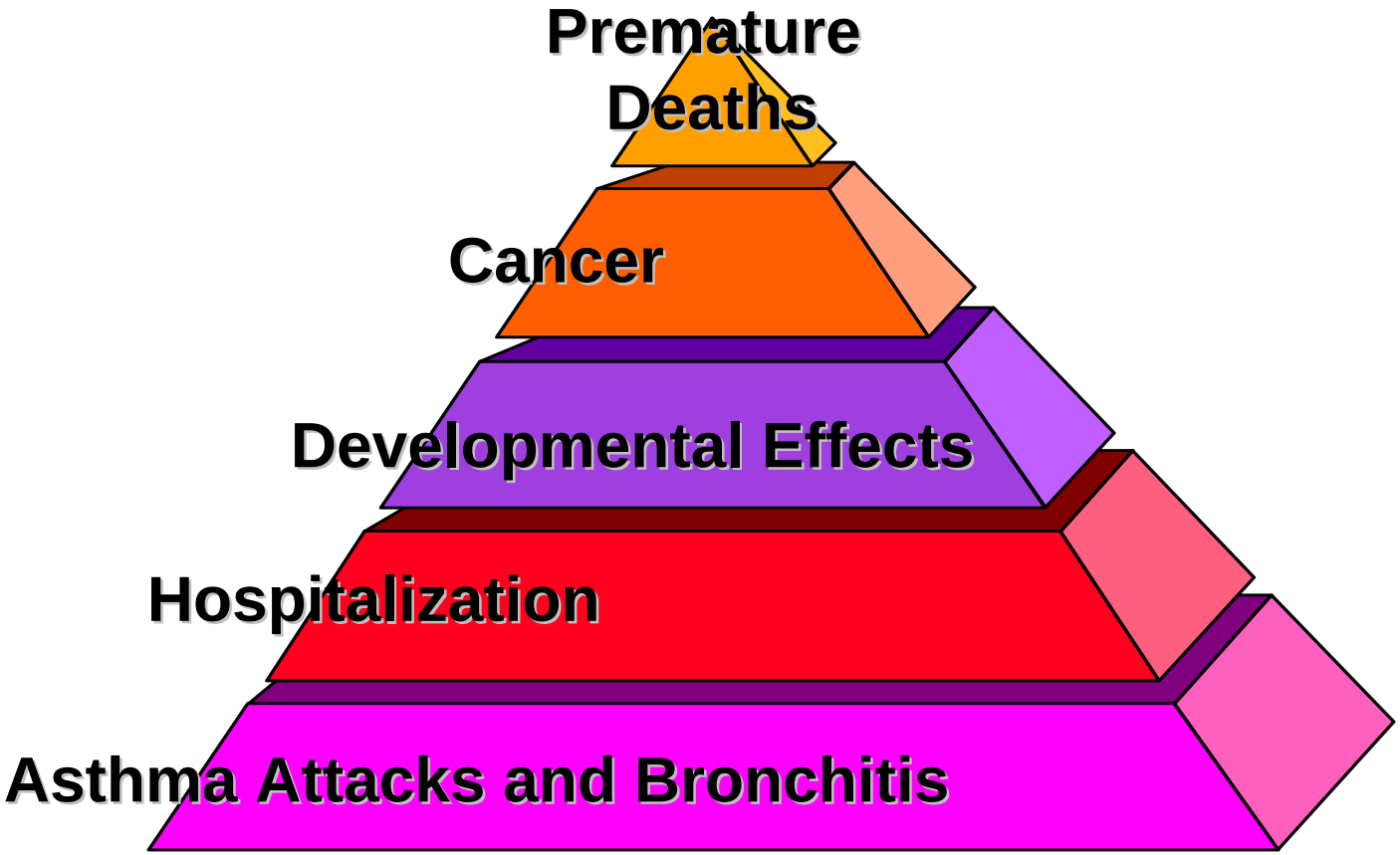
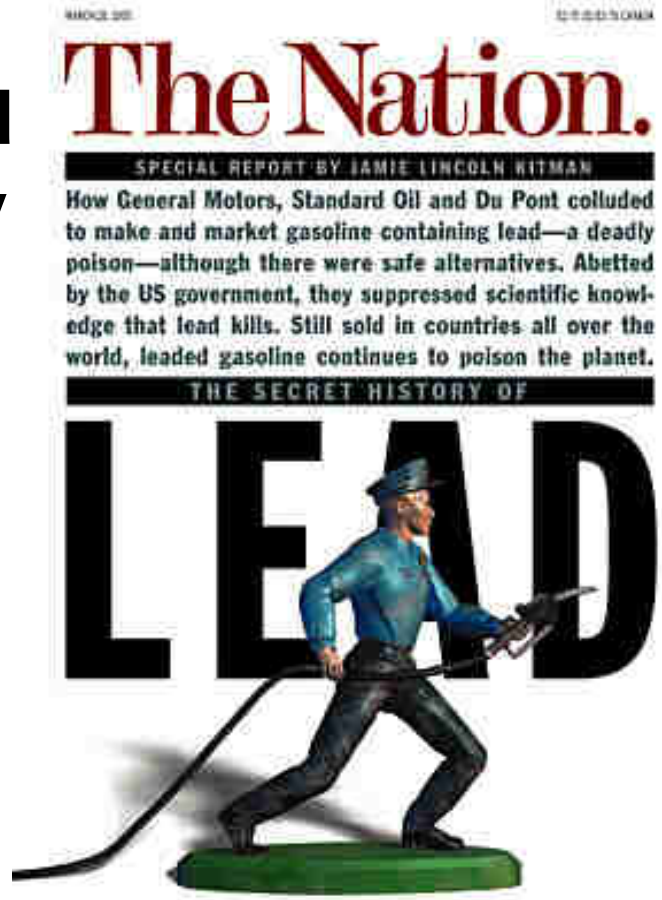
Air pollution: health effects



“and a witness of her household bore witness”

“Hidden History of Leaded Gasoline Reveals Industry Conspiracy to Conceal Dangers.
Lethal Product Still Marketed Throughout The World.”



Lead in Roman Empire, 1st Century B.C.

Inexpensive reliable metal suitable for many everyday uses

Water network, kitchen ware, cosmetics, paint pigment, spermicide, food seasoning, food & wine adulteration, lead coin,
counterfeit silver & gold coin,……etc

Romans were aware of lead deleterious health effect:

Madness, gout, stillbirths, sterility, impotence, ……death

Yet, they held to the belief: limited exposure = limited risk

Lead in USA, 20th Century

1921: TEL acknowledged as an excellent anti-knock additive to gasoline,

1923-1924: TEL toxic effects encountered and warned of, yet ignored,

1927–1986: Extensive use of leaded gasoline.

1976 –19??: Phasing out leaded gasoline

Lead Usage Rate

Roman Empire, 1st Century:
550 gm / Person / Year

USA, 1980:
5,221 gm / Person / year

Sources of Environmental Contamination with Pb

1- Leaded gasoline

2- Solid waste incineration,

3- Coal and oil combustion,

4- Iron and steel production,

5- Lead smelting,

6- Copper smelting

7- Soldering cans

8- Ore crushing & grinding,

9- Portland cement industry

10- Storage battery industry,

11- Lead glass industry,

12- Crop enhancer

Leaded Gasoline,

A major source of environmental contamination with Pb

1- Combustion of leaded Gasoline = 88% of the total Pb emissions to atmosphere. 75% of added Pb is emitted in vehicles & engines exhaust, mostly as Pb particulates, to a lesser extent as gaseous Pb

2- Losses during filling of gas tanks, ? GS attendants' exposure

3- Evaporation during accidental spills (unchanged TEL), ? GS workers

4- Release during production of gasoline &TEL

Fate of lead Particulates in the atmosphere

1- Deposition on the ground,

2- Dispersion in soil and water,

“Lead reservoir in soil”

Phasing Out Leaded Gasoline: a Priority

Lead toxicity, a well known fact,

Dispersive nature of fine particulates emitted,

Entry into human body is easy,

Children vulnerability.

Deposition on soil creates long standing hazards.

Leaded gasoline phased out, yet lead is still ther

- Lead emissions from certain industries,
- Soil reservoir,
- Lead accumulation in bone, Pb half life 6-10 yrs, lead mobilization in certain conditions, examples
- Fine lead particulates in the atmosphere.

Entry of Lead into the Body thru:

- Respiratory system: Inhalation
- Digestive system: Ingestion
- Skin: Contact.

Fate of Inhaled Lead Particulates

- Inhaled lead PM >0.5 µm are barely retained in lungs,
- larger particulates are coughed up & swallowed,
- 90% of ≤0.5 µm particulates are retained
- Absorption of retained Pb in lungs is efficient & complete.

Lead Ingestion

Ingestion is the major source of lead poisoning in children:

- Ingestion of dust and soil: hand to mouth activity
- Consuming contaminated fruits and vegetables
- Swallowing coughed out large particulates
- Drinking contaminated water "old water network"

Transcutaneous Absorption

- Minimal absorption thru intact skin. "↑Injury"
- Inorganic lead is not absorbed,
- TEL (organic compound) may enter thru skin
- TEL in the body → inorganic lead

Lead Toxicity; age groups mostly affected

1- Children 6 years are the most vulnerable:

- Hand to mouth activity and pica,
- Children growing systems absorb more lead,
- Children CNS is more sensitive to damage.
- More prone than adults to nutritional deficiencies.

2- Workers in lead – risk occupations.

Lead Level

Blood, Adults, general population: ☐ 20 mcg / dl

Blood, workers in Lead risk occupation: ☐ 40 mcg / dl

Blood, workers who intend to have children: ☐ 30 mcg/dl

Blood, children: ☐ 10 mcg / dl

Blood, children: 40 mcg / dl necessitates treatment.

Air, workplace: PEL 30 - 50 mcg / cubic meter, averaged over 8 hours / workday

Air, public exposure: ???? Mcg / cubic meter.

Lead Poisoning, Patient's History

Symptoms are not specific

- GIT: abdominal pain, anorexia, constipation, vomiting.
- Neurobehavioral: Inattentiveness, distraction, recklessness, learning problems.
- Reproductive: ↓ sex drive, impotence, sterility, stilbirths
- General: fatigue, weakness, dizziness. "Rare in children"

Lead Poisoning, Signs

Signs are non specific too, severity varies

- Buccal stains, gingival lead line
- Pallor (picture of anemia)
- Hyperactivity
- Signs of increased IC pressure: impaired consciousness, bradycardia, hypertension, respiratory depression, papilledema, coma
- Hyperuricemia, aminoacidurea, gout, renal failure.

Lead Poisoning, Investigations

- **Blood tests**

  Blood sugar: ? cause of coma

  CBC: anemia, basophilic stippling

  BLL

  EP

  Delta ALL

- **Urine tests**

  Routine MSU

  Delta ALL

Lead Poisoning, Investigations

- **X-Ray:**
  lead flakes in abdomen,
  lead lines in extremities

- **CT scan:**
  brain edema, increased IC pressure,
  structural lesions in the brain

Lead Poisoning, Treatment

- **Role of Patient and Patient's Family**

Prevention of further exposure,

Correction of faulty conditions generating lead,

Correction of nutritional deficits,

Follow ups, repeat BLL tests,

Parents: Keep in mind, the possibility of lead poisoning in children with ..... Request BLL whenever in doubt.

- **Medications**

Professional doctors *ONLY* assigned to carry out.

References

The History of Lead Information retrieved on 18 thru 23 July, 2008 by Moh'd Khalili, MBChB, DCH, MSc., JMCC Directorate of Environmental Health, MOH, Amman, Jordan. **mohdkhalili@yahoo.com** from articles and information available on the following websites:

http://www.unep.org
http://www.epa.gov
http://www.emedicine.com
http://www.atsdr.cdc.gov
http://springerlink.com
http://lead.org.au

Why lead was added

- As an octane enhancer, to prevent engine knock

  However,

- Refinery technology has improved
- Modern cars manufactured with hard valve seats
- Valve seat recession not likely as occurs under conditions of lengthy high speed driving

Why phase-out lead

- Lead is highly toxic
- Lead from gasoline is highest source of atmospheric lead
- Lead has serious health impacts (impairs development of brain function in children and lowers IQ; increases heart and respiratory diseases in adults among other associated diseases)
- No level of lead is safe

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Leaded gasoline: Health Effects (example Egypt)

- Heart Attacks - 6,500 to 11,600
- Strokes - 800 to 1,400
- Premature Deaths (Adults) - 6,300 to 11,100
- Infant Deaths - ~820
- Average IQ Loss in Children - 4.25 Points
- Egypt went unleaded

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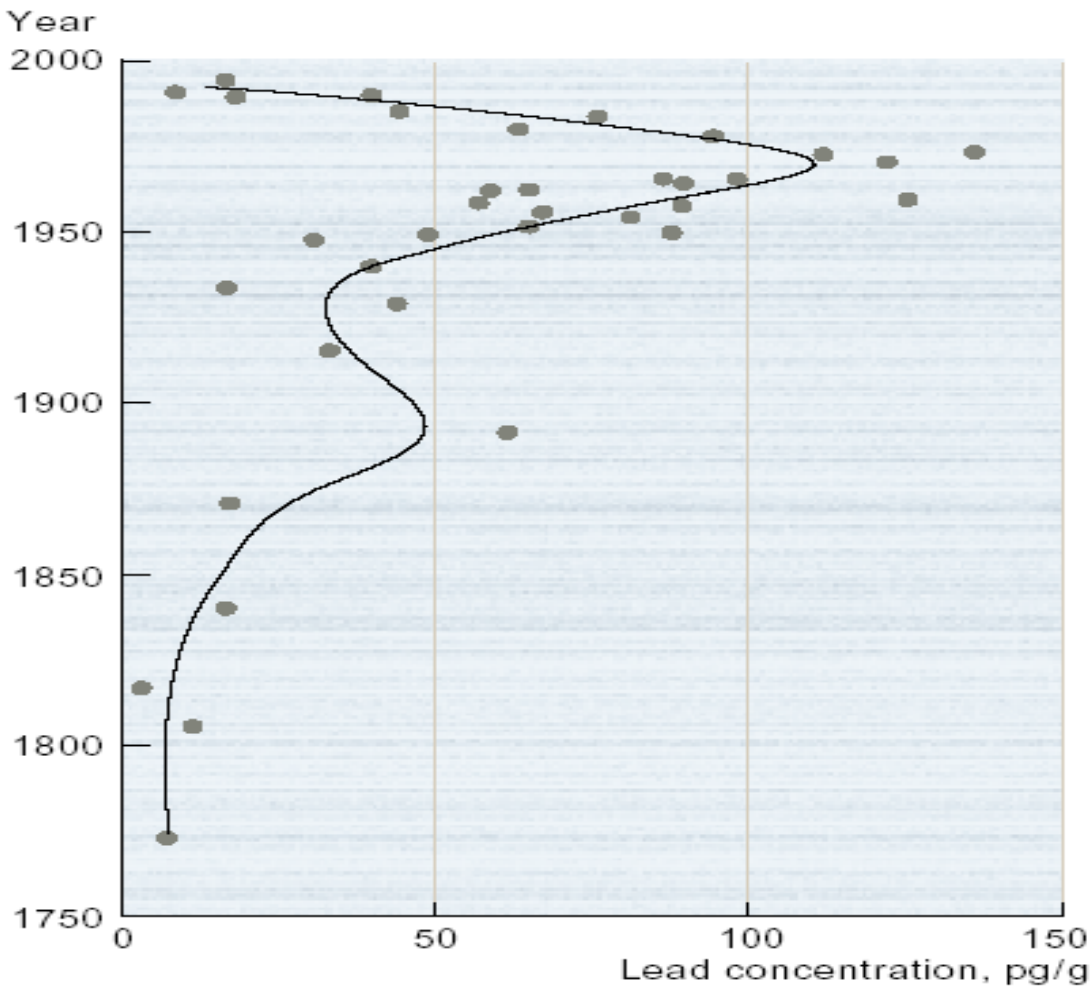
Lead in Ice Core of Greenland



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Benefits of unleaded gasoline

- Reduces atmospheric lead level
- Allows for introduction of catalytic converters
- Catalytic converters reduce other emissions (e.g carbon monoxide, nitrogen oxide, hydrocarbons) by up to 90%
- Is cheaper and reduces vehicle maintenance costs

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Promoting unleaded gasoline: benefits

ULG : better for your car

- fouling up engine
- corrosion exhaust

ULG: better for your wallet

- reduced maintenance costs engine & exhaust
- slight efficiency improvement

ULG: better for health and environment

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Experiences

- Over 85% of gasoline consumed worldwide is unleaded
- Leaded gasoline used in North Africa, East Europe and two countries in Middle East
- Study by UNEP/JKUAT in Kenya showed high lead levels in soil & food

  * Concentrations high in cities and near highways

  * Lead in vegetable samples 25 times higher than WHO standard

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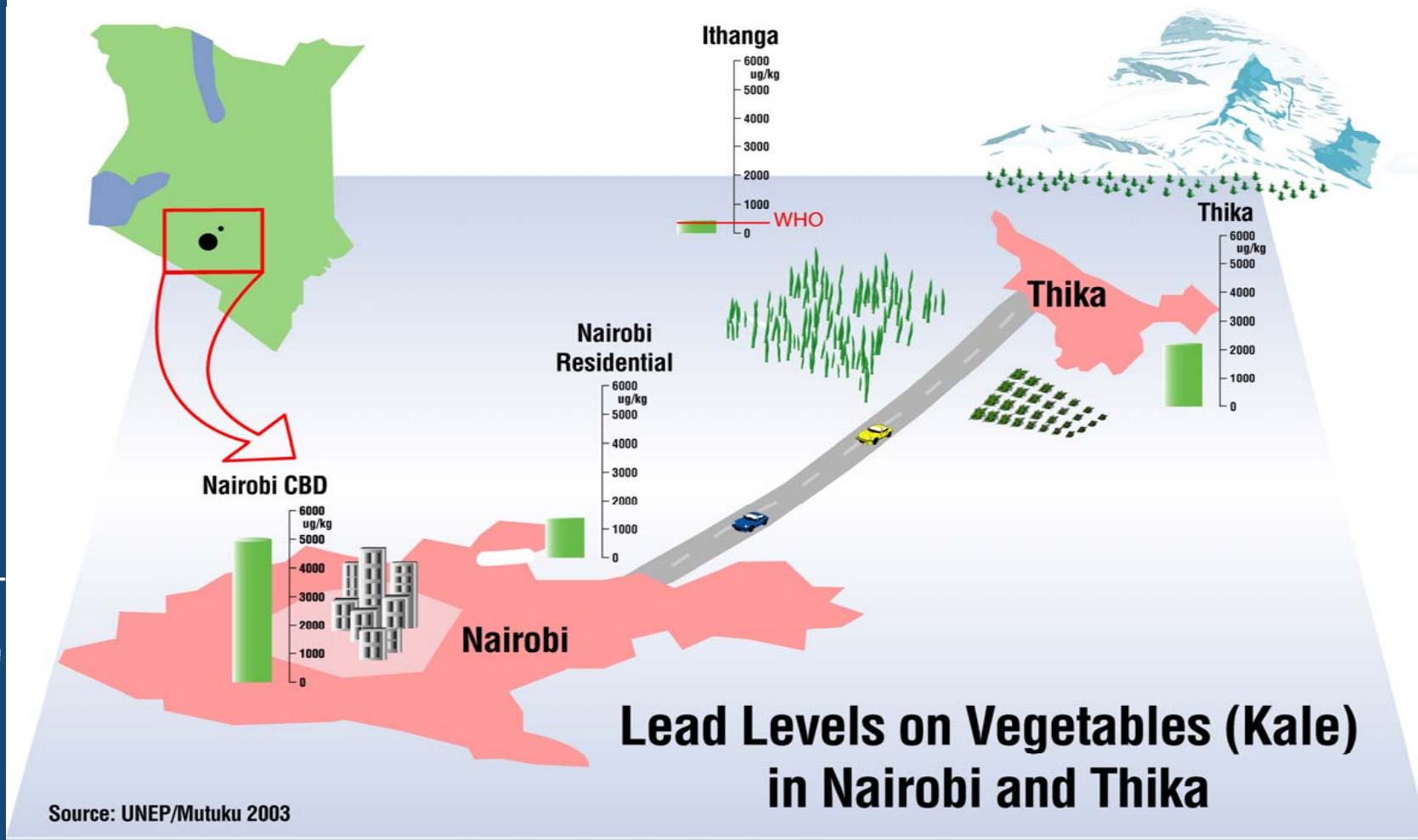
Lead Levels in and around Nairobi (UNEP/JKUAT study)



Way Forward

- For oil importing countries
  - Joint effort of all stakeholders
    - Government Policy pronouncement
    - Introduce legislation/grade
- Countries with refining capacity
  - Decision on refinery closure or upgrading

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After phase-out

Other important issues include:

- Sulfur in fuels
- Clean vehicles technologies
- Clean vehicles
- Urban air quality monitoring
- Emission measurement