

# A Small Dose of Lead

## Occupational Lead Regulations - Implications for Children

CHE-WA  
University of Washington  
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[www.asmalldoseof.org](http://www.asmalldoseof.org)  
[www.toxipedia.org](http://www.toxipedia.org)

# **Thank you**

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**With help from  
Rachel Shaffer**

**PhD Student, Environmental  
Toxicology  
Department of Environmental and  
Occupational Health Sciences  
University of Washington School of  
Public Health**



# What to do? Write Editorials!

**Rachel Shaffer and Steven Gilbert. Commentary: Lead exposure beyond Flint—protecting our nation's workers.**

Environmental Health News. Sept. 12, 2016.

<http://www.environmentalhealthnews.org/ehs/news/2016/sept/commentary-lead-exposure-beyond-flint2014protecting-our-nation2019s-workers>

**Rachel Shaffer and Steven Gilbert. Outdated lead standards put Washington workers, families at risk Seattle Times.**

August 1, 2016.

<http://www.seattletimes.com/opinion/outdated-lead-standards-put-washington-workers-families-at-risk/>

**Write a paper – be ready for rejection**

**Reducing Occupational Lead Exposures: Strengthened Standards for a Healthy Workforce**



# Occupational Lead Exposures: Child Health Implications of Outdated Standards

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## Introduction

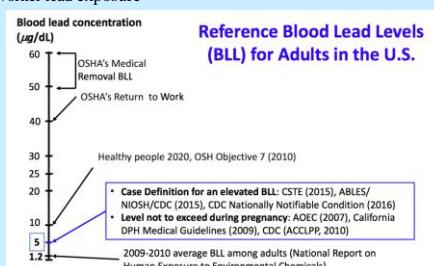
The U.S. Centers for Disease Control and Prevention (CDC) has stated that there is no safe level of lead exposure and has defined an elevated blood lead level ( BLL) for children as any BLL greater than 5 µg/dL. It is estimated that over 500,000 U.S. children ages 1 to 5 have BLLs greater than 5 µg/dL. While there are a number of possible sources of childhood lead exposure, a relatively unexplored and underappreciated source is occupational lead exposure. Occupational lead exposure can affect children because lead is easily taken home on worker clothing or shoes, thereby contaminating the home. Children are uniquely vulnerable to the effects of lead because of their developing nervous systems and high calcium needs. Existing occupational lead standards are severely outdated and allow exposures that result in BLL up to 40-60 µg/dL. The Occupational Safety and Health Administration (OSHA) estimates that approximately 804,000 workers in general industry and an additional 838,000 workers in construction are potentially exposed to lead. Workers are exposed to lead as a result of the production, use, maintenance, recycling, and disposal of lead material and products, construction, manufacturing, wholesale trade, transportation, remediation and recreation such as fishing, hunting, and firing ranges. To demonstrate the importance of updating federal occupational lead standards, we perform example calculations that estimate the number of children exposed to lead through occupational exposure. Assuming only 10% of possible workers exposed to excessive amounts of lead bring contamination into the home, there would be 160,000 potential opportunities of family lead exposure. If each of these families had only one child exposed to take-home lead, then occupational lead exposure would contribute to elevated childhood lead exposure across the country. This does not include the millions of people that use gun firing ranges, which also accounts for occupational and non-occupational lead exposure. Therefore, to adequately protect workers and their families, occupational lead standards should be updated to prevent BLLs greater than 5 µg/dL. This change would eliminate the arbitrary distinction between workers and children. We have an ethical responsibility to protect workers and children from known hazards such as lead.

## Existing Inadequate Workplace Standards

OSHA regulates workplace lead exposure through two standards, the **general industry standard** and the **construction standard**. Both of these are based on scientific and medical evidence from the 1970s and do not reflect updated information regarding the hazards of low level lead exposure.

Examples of key inadequacies of the current standards are outlined below:

- Exposures of lead that result in up to 60 µg/dL BLLs (or an average of 50 µg/dL BLL on three or more tests) are allowed before medical removal is required
- Workers can return to work when BLLs are as high as 40 µg/dL
- The permissible enforceable limit (PEL) is set at 50 µg/m<sup>3</sup> over 8 hours, which allows for BLLs as high as 60 µg/dL
- Reliance on air lead levels as entry condition for the occupational lead standard ignores the role of ingestion in worker lead exposure



## Populations at Risk

### Industries reporting the highest percentage of BLLs > 25 µg/dL among workers

Manufacturing	Construction	Services	Mining
Storage battery manufacturing	Painting and wall covering contractors	Remediation services	Copper, nickel, lead, zinc mining, gold
Alumina and aluminum production and processing	Highway, street, and bridge construction	Amusement and recreation services	
Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying	Residential building construction	Automotive, mechanical, and electrical repair and maintenance	

### Industries with commonly reported family lead exposure

- Lead smelting
- Battery manufacturing/recycling
- Radiator repair
- Electrical components manufacturing
- Pottery/ceramics
- Stained glass making
- Carpentry / remodeling / furniture repair

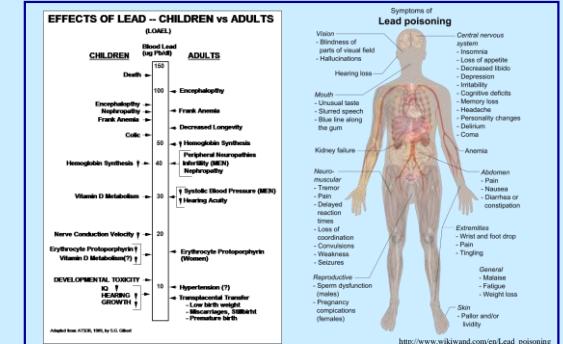
### Worker populations of particular concern

- Younger workers ages 14-21
  - Organ systems are still developing
  - Neurological systems especially vulnerable
- Women of reproductive age
  - Implications for fetal & child exposures
- Ethnic/minority groups:
  - Disproportionate exposures based on job patterns
  - May have inadequate understanding of risks because of language barriers

## Take-Home Lead Exposure: Estimated Risks to Children

- OSHA estimates of workers exposed to lead:
  - General industry: 804,000 workers
  - Construction industry: 838,000 workers
  - *Not included: potential exposure through firing/shooting ranges*
- Estimates of child exposures from take-home lead (based on Rosco et al 1999):
  - If we assume that 10% of all workers take lead home to their families, then 160,000 families affected by occupational lead exposure
  - If we assume that one child per family is affected, then 160,000 children might be exposed through take-home lead exposure from the workplace
- Occupational lead exposure due to inadequate OSHA standards may result in elevated risk of lead exposure in children
- Further work is needed to quantify the frequency and magnitude of take-home exposures

## Implications of Lead Exposure



## Conclusions & Recommendations

- Current occupational lead standards are not protective for workers and their families.
- Occupational lead standards should be updated to prevent BLLs greater than 5 µg/dL in all workers, in accordance with current scientific and medical evidence. This change would eliminate the arbitrary distinction between workers and children.
- Children of workers exposed to lead on the job should receive regular BLL screening
- CDC acknowledges that there is no safe level of lead. We have an ethical responsibility to protect workers and children from known hazards such as lead.

## References

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# Little Things Matter

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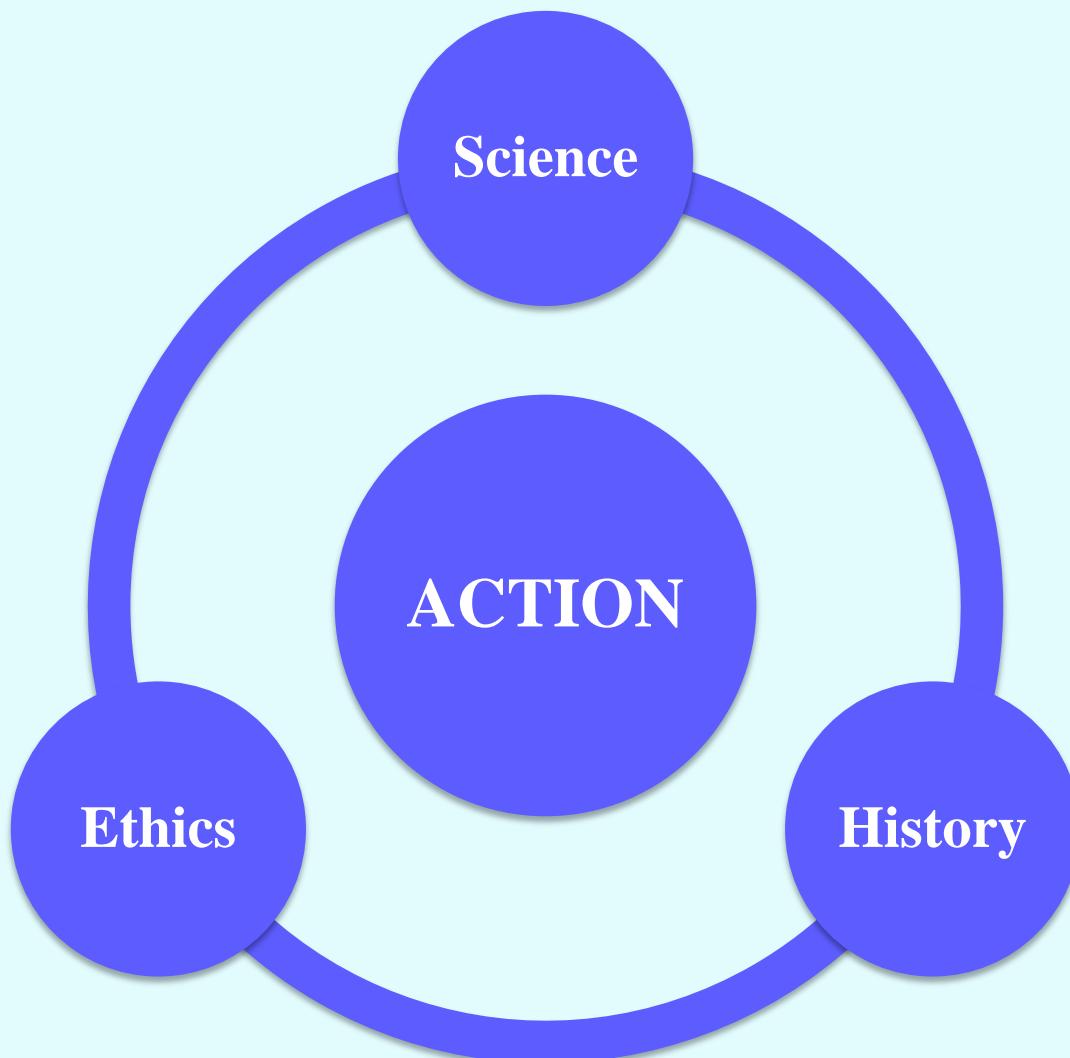
## Little Things Matter: The Impact of Toxins on the Developing Brain

[Go here](#)

<https://www.youtube.com/watch?v=E6KoMAbz1Bw>



# Fundamental Dots



# Fundamental Dots

## Connecting the Dots for Health Childhood Lead Exposure

### Action

Eliminate childhood so that blood lead levels are less than 1 ug/dL

### Science

CDC – “NO safe level of exposure”  
CDC - Action level 5 ug/dL  
Harms Nervous system – decreases IQ  
Lead substitute for calcium  
Children Absorb 50% adults only 10%

Science

Action

Ethics

History

### Ethics

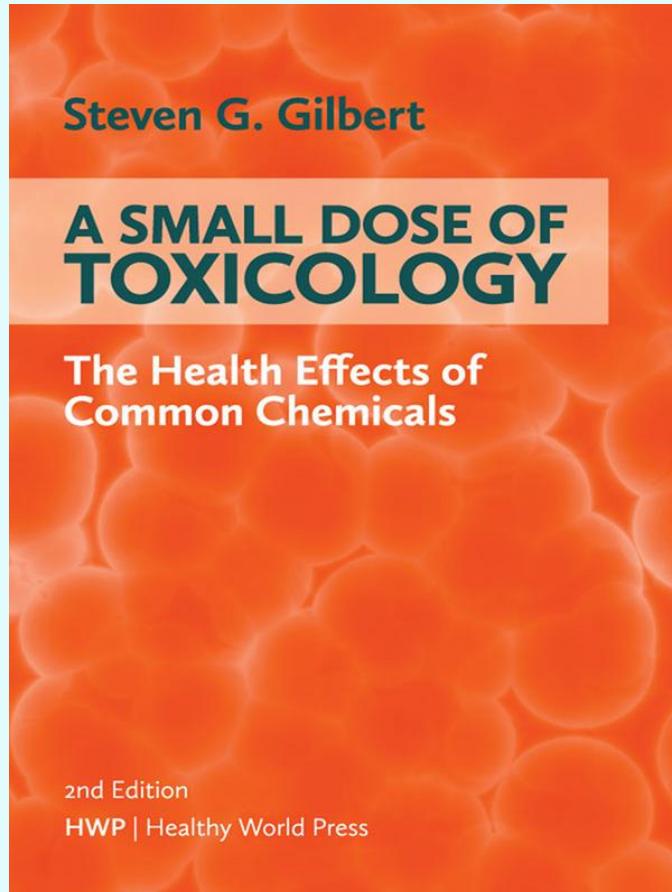
Right to lead free environment  
Reach and maintain full potential

### History

“lead makes the mind give way”  
1922 – lead paint banned Europe  
1978 – lead paint banned in US  
1920’s – lead added to gasoline



# A Small Dose of Toxicology 2<sup>nd</sup> Edition



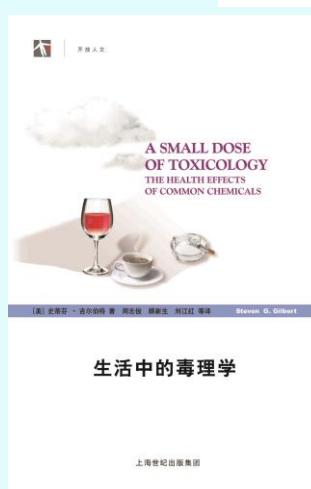
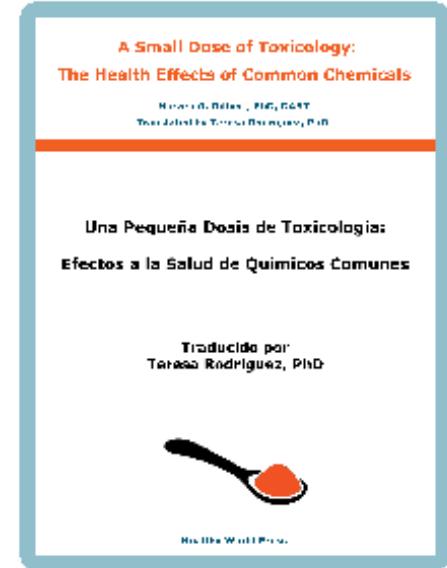
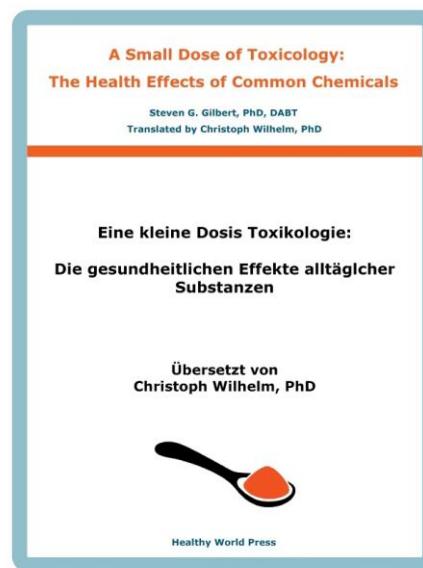
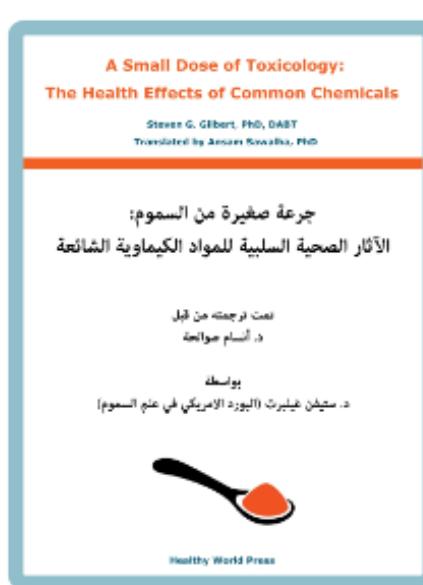
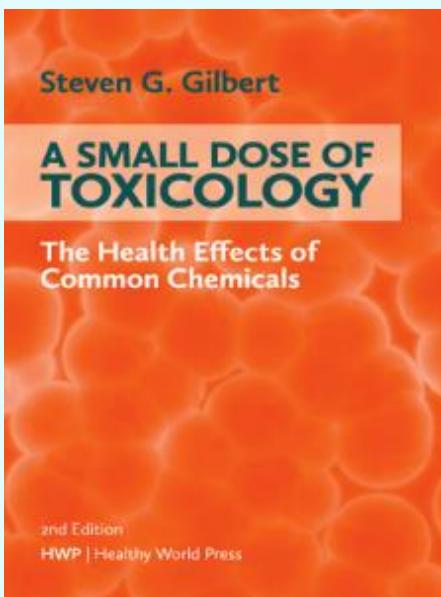
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# Milestones of Toxicology

## Milestones of Toxicology

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<sup>1</sup>Institute of Neurotoxicology and Neurological Disorders and <sup>2</sup>Northeastern University

Contact information: Steven G. Gilbert at sgilbert@imnd.org – more information at [www.asmalldoseof.org](http://www.asmalldoseof.org) – © 2005 Steven G. Gilbert

<table border="1"> <tbody> <tr> <td colspan="2"><b>Antiquity</b> 3000 BCE – 90 CE</td><td><b>Shen Nung</b> 2696 BCE The Father of Medicine, noted for tasting 365 herbs and said to have died of a toxic overdose.</td><td><b>Ebers Papyrus</b> 1500 BCE Egyptian records contain 700 pages on anatomy and physiology, toxicology, spells, and treatment recorded on papyrus.</td><td><b>Gula 1400 BCE</b>  Sumerian deity refers to a female deity, Gula. This mythological figure was associated with charms, spells and potions.</td><td><b>Homer</b> 850 BCE Wrote of the Trojan War and composed with vision in the epic tales of <i>The Odyssey</i> and <i>The Iliad</i>. From Greek <i>hormē</i> – active chemical arrow poison.</td><td><b>Socrates</b> (470-399 BCE) Charged with corrupting the youth. Accused of corrupting the morals of local youth. Death by hemlock – active chemical alkaloid of camphor.</td><td><b>Hippocrates</b> (460-377 BCE) Greek physician, an early proponent of the approach to human disease and treatment. Founder of modern medicine, named cancer after creeping crab.</td><td><b>Mithridates VI</b> (131-63 BCE) Tempted and doted on poison. Known for his tolerance to poisons – was created numerous of substances leading to term mithridatikos.</td><td><b>L. Cornelius Sulla</b> 82 BCE  <i>Les Coriolles de Sulla</i> – he used poison and other poisons on prisoners, could not buy, sell or possess poison.</td><td><b>Cleopatra</b> (69-30 BCE) Experimented with poisons and other poisons on prisoners and poor. Committed suicide with Egyptian Asp.</td><td><b>Pedanius Dioscorides</b> (40-90 CE) Greek pharmacologist and physician wrote <i>De Materia Medica</i> basis for the modern pharmacopeia.</td><td><b>Mount Vesuvius</b> 79 CE City of Pompeii &amp; Herculaneum destroyed and buried by ash. Pliny the Elder suffocated by volcanic gases.</td></tr> </tbody> </table>												<b>Antiquity</b> 3000 BCE – 90 CE		<b>Shen Nung</b> 2696 BCE The Father of Medicine, noted for tasting 365 herbs and said to have died of a toxic overdose.	<b>Ebers Papyrus</b> 1500 BCE Egyptian records contain 700 pages on anatomy and physiology, toxicology, spells, and treatment recorded on papyrus.	<b>Gula 1400 BCE</b>  Sumerian deity refers to a female deity, Gula. This mythological figure was associated with charms, spells and potions.	<b>Homer</b> 850 BCE Wrote of the Trojan War and composed with vision in the epic tales of <i>The Odyssey</i> and <i>The Iliad</i> . From Greek <i>hormē</i> – active chemical arrow poison.	<b>Socrates</b> (470-399 BCE) Charged with corrupting the youth. Accused of corrupting the morals of local youth. Death by hemlock – active chemical alkaloid of camphor.	<b>Hippocrates</b> (460-377 BCE) Greek physician, an early proponent of the approach to human disease and treatment. Founder of modern medicine, named cancer after creeping crab.	<b>Mithridates VI</b> (131-63 BCE) Tempted and doted on poison. Known for his tolerance to poisons – was created numerous of substances leading to term mithridatikos.	<b>L. Cornelius Sulla</b> 82 BCE  <i>Les Coriolles de Sulla</i> – he used poison and other poisons on prisoners, could not buy, sell or possess poison.	<b>Cleopatra</b> (69-30 BCE) Experimented with poisons and other poisons on prisoners and poor. Committed suicide with Egyptian Asp.	<b>Pedanius Dioscorides</b> (40-90 CE) Greek pharmacologist and physician wrote <i>De Materia Medica</i> basis for the modern pharmacopeia.	<b>Mount Vesuvius</b> 79 CE City of Pompeii & Herculaneum destroyed and buried by ash. Pliny the Elder suffocated by volcanic gases.
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<b>Middle Ages</b> 476 CE – 1453	<b>Greek Fire</b> 673 CE Ancient "napalm" described by the Crusaders as consisting of naphtha, quicklime, sulphur, & saltpeter.	<b>Ergot Outbreak</b> 999 CE 40,000 died from eating contaminated wheats/breads caused ergotism known as St. Anthony's Fire.	<b>Moses Maimonides</b> (1135-1204) Jewish philosopher & physician wrote <i>Treatise on Distress and Their Avodah</i> .	<b>Albertus Magnus</b> (1193-1280) Dominican friar wrote extensively on compatibility of religions and science and treated arsenic as "sweet wine".	<b>Raymundus Lullus</b> 1275 First discovered by Spanish chemist and later called "sweet wine".	<b>Knights Templars</b> (1118-1307) Christian military order alleged to be experts with poisons. They received for the "Three of Life".	<b>Petrus Abano</b> (1250-1315) Italian scholar translated Hippocrates and Galen to Latin. Wrote book on poison <i>De Poisina</i> .	<b>The Black Death</b> (1347-1351) Italian scholar translated Hippocrates and Galen to Latin. Wrote book on poison <i>De Poisina</i> .	<b>Venetian Council of Ten</b> 1419 Group of 10 people who carried out murders with poisons in Jaffa Australia.	<b>Zhou Man</b> 1423 Chinese explorer led 1000s of crew members from uranium exposure while mining lead in Jaffa Australia.	<b>Rodrigo &amp; Cesare Borgia</b> (1400-1500) Killed many people in Italy for political and monetary gain. Died arsenic in a concoction called "La Castella".													
<b>Renaissance</b> 14th–16th Centuries	<b>Leonardo da Vinci</b> (1452-1519) Inventor of poisons in animals and called the procedure "passages".	<b>Pope Clement VII</b> (1478-1534) Died (poisoned) after taking arsenic <i>Phallosis</i> (death cap) mushroom.	<b>Paracelsus</b> (1493-1541) Swiss physician and alchemist wrote <i>Paracelsus</i> dedicated to poisons, minerals, plants and animals.	<b>Georgius Agricola</b> (1494-1555) Queen of France, naturalist, mineralogist, and poet on the sun and the moon.	<b>Catherine Medici</b> (1519-1589) Queen of France, naturalist, mineralogist, and poet on the sun and the moon.	<b>William Piso</b> 1640 Ingested effects of <i>Cayenne pepper</i> , an emetic, treat dysentery.	<b>Shakespeare</b> (1564-1616) From Roman & Italian writers & physicians. Wrote many plays including <i>Othello</i> & <i>King Lear</i> .	<b>Hieronymus Spara</b> 1659 From Roman & Italian writers & physicians. Wrote many plays including <i>Othello</i> & <i>King Lear</i> .	<b>Catherine Monvoisin</b> (1615-1719) French woman who was accused of poisoning her husband and son to murder their husbands. Lured them by strangulation.	<b>Gilia Tophania</b> (1635-1719) Italian woman who was accused of poisoning her husband and son to murder their husbands. Lured them by strangulation.	<b>King Louis XIV</b> 1652 Passed royal decree regarding apothecaries to sell arsenic or poisons substances except to persons known to them.													
1700s	<b>Devonshire Colic</b> 1700's Devonshire, England. High incidence of lead colic drinking contaminated cider.	<b>John Jones</b> 1701 English doctor wrote <i>The Mystery of Opium</i> described many treatments of poisons, but also withdrew and sold.	<b>Richard Meade</b> (1673-1754) In 1703, wrote <i>A Mechanical Account of Poisons</i> dedicated to poisons, minerals, plants and animals.	<b>Carl Wilhelm Scheele</b> (1742-1786) Swedish physician and chemist discovered coal-tar causes cancer of the scrotum in 1765. First isolated cyanide in 1781.	<b>Percivall Pott</b> (1714-1788) British physician and surgeon, discovered mercury, arsenic, carbon tetrachloride, and hydrocyanide.	<b>Felice Fontana</b> 1767 Italian chemist and physiologist who was the first to study venoms of snakes. Discovered that viper venom affects blood.	<b>Frederick Sertürne</b> (1783-1841) Isolated arsenic from copper pyrite in 1813. He named it Arsenic after Marsyas, the Greek god of drama.	<b>Francoise Magendie</b> (1783-1855) Discoverer of routine and studied effects of strychnine & cocaine. Called "Madame" and was from France.	<b>Fowler's Solution</b> (1786-1936) Poisonous arsenic solution prescribed and sold by Henry Fowler. Also was used by Dr. John Snow in 1915, subject of <i>Dengue</i> .	<b>Pierre Ordinaire</b> (1797-1853) Considered the father of modern toxicology. In 1813 he published <i>Principes des Poisons</i> , which described the symptoms of poisons.	<b>Matthew J.B. Orrillia</b> (1787-1853) Considered the father of modern toxicology. In 1813 he published <i>Principes des Poisons</i> , which described the symptoms of poisons.													
1800s	<b>Thomas de Quincey</b> (1785-1859) English writer, became addicted to opium nearly 1000s of times per year, purchased Opium from Queen Victoria in 1821.	<b>James Marsh</b> (1794-1846) Chemist developed and perfected the Marsh test for arsenic. The improved Marsh test for arsenic was used for the first time in 1840 during the trial of Marie Lafarge, that contained arsenic and lead.	<b>Robert Christison</b> (1797-1882) Physician at University of Edinburgh wrote <i>Practise on Poison</i> in 1829 invented poison barometer, for whaling that contained arsenic and lead.	<b>Claude Bernard</b> (1813-1878) French physician studied the effects of carbon monoxide and cocaine. Influenced by Prout's Law.	<b>Ascanio Sobrero</b> (1812-1888) Italian chemist discovered nitroglycerin, a powerful explosive and incendiary. Alfred Nobel was his student.	<b>Theodore G. Wormley</b> (1812-1897) Wrote the first American book dedicated to poison in 1869. Also invented adhesive mercury ointment.	<b>Joseph Caventou &amp; Pierre Pelletier</b> 1820 French pharmacists isolated quinine from bark of Cinchona tree in bulk of their pharmacy.	<b>Arsenic Act 1851</b> Required arsenic to be labeled with red ink to prevent "accidental" poisoning.	<b>Louis Lewin</b> (1854-1929) German physician studied and classified hallucinogenic plants, alkaloids and other psychoactive compounds.	<b>Emil Fischer</b> 1852-1919  Isolated the insulin sufficient from plant extracts in 1895.	<b>Constantine Fahlberg</b> Saccharin 1879 Constantine Fahlberg discovered saccharin while working in the laboratory of his Professor in 1879.													
1900-1930s	<b>Upton Sinclair</b> (1878-1969) Fictional novel <i>The Jungle</i> in 1906. Chronicled the sanitary condition in meat packing industry in Chicago.	<b>Pure Food and Drug Act - 1906</b> Housewoman Wiley, MD (1884-1930). Law prevents adulteration of food, drugs, and medicines.	<b>Chemical Warfare A</b> 1915 Germany developed chlorine gas.	<b>U.S. Prohibition</b> 1919-1933 Banning of alcohol production and sale of alcoholic beverages.	<b>Geneva Protocol</b> 1925 Laws made to regulate production and sale of chemical weapons.	<b>Ginger Joke 1929</b> Alcoholics once produced illegally during prohibition adulterated with TOCP (produced OPIDIN (Ginger Liqueur).	<b>Hawkin's Nest Incident 1927-1935</b> Poisonous bird nests were eaten while digging tunnel for a hydroelectric project in Hawaii.	<b>Gerhard Schrader</b> (1903-1990) Discovered mustard gas accidentally.	<b>Elixir Sulfanilamide</b> 1937 Food Drug & Cosmetic Act 1938 LSD was synthesized in the Sandusky Laboratory (now Novartis). In 1943 Hoffmann tested LSD on himself.	<b>Albert Hofmann</b> 1938 LSD was synthesized in the Sandusky Laboratory (now Novartis). In 1943 Hofmann tested LSD on himself.	<b>Marijuana Tax Act</b> 1937 Federal criminal offense to possess, produce, or dispense hemp. Non-medical use prohibited in California (1915) and Texas (1937).													
1940-1960s	<b>DDT – 1939</b> Recognized as the most potent insecticide by the French scientist Paul Hermann Muller, who was awarded the 1948 Nobel Prize in Physiology and Medicine. Banned in 1972.	<b>Minimata Japan</b> (1950's) Marine life contaminated with mercury by chemical industry. Thousands adults and children were poisoned from a single water source contaminated by mercury.	<b>Poison Control Centers 1953</b> First, Chicago 1953 spread to Dade, Florida, NC in 1954, and third opened in Boston 1955	<b>Journal of Tox. &amp; App. Pharmacology</b> 1959 Liquor laws required to prepare warning for morning sickness induced birth defects.	<b>Thalidomide</b> (1958-1960's) Developed in Germany to treat morning sickness.	<b>Society of Toxicology</b> 1961 Founded in March 1961 at the formal meeting held April 15, 1962 (9 founders, 183 charter members).	<b>Alice Hamilton</b> (1869-1970) Scientist and medical expert for use of organic solvents in laboratories (DDT) a pesticide and persistent organic pollutants. Won several awards including the Springville Gold Medal in 1962.	<b>Rachel Carson</b> (1907-1964) Scientist and environmentalist for use of organic solvents in laboratories (DDT) a pesticide and persistent organic pollutants. Carson several books including <i>Silent Spring</i> published 1962.	<b>Occupational Safety &amp; Health Act 1970</b> Established to monitor industrial research, monitoring, standard setting and enforcement activities to ensure human & environmental protection.	<b>OSHA</b>														
1970-2006	<b>Mr. Yuk</b> 1971 Symbol adopted by the National Poison Control Center. The Children's Hospital in 1971. Used to educate children and parents about poisons and to prevent accidental poisonings.	<b>Iraq – Mercury</b> 1971 Pink colorant was created with a mixture of arsenic and mercury. It tragically affected 40,000 people.	<b>Bangladesh 1970's</b> Arsenic poisoning	<b>First Modern Toxicology Textbook</b> 1975 Louis J. Casaretti & John Doull edited, <i>Toxicology: The Basic Science of Poisons</i> , in 1975.	<b>Love Canal Disaster</b> 1978 August 7, 1978 Love Canal declared Love Canal a federal emergency. 42 million pounds of over 200 chemicals contaminated Love Canal, disrupting many lives.	<b>IUTOX 1980</b> International Union of Toxicology American Board of Toxicology (ABT)	<b>Times Beach 1983</b> Dangerous levels of dioxin found in Times Beach, MO. EPA orders the town evacuated and makes it a Superfund site. All residents gone by 1982.	<b>Bhopal Disaster</b> Dec. 3, 1984 The Chlordi methyl isocyanide plant produced a plume of reductive debris over the Union Carbide plant in Bhopal, India, and injured 100s of thousands.	<b>Chernobyl Accident</b> April 26, 1986 Accidental release of 40 million curies of radioactive iodine from a Union Carbide nuclear power plant in Chernobyl, Ukraine, Eastern Europe, contaminated 100s,000s of people.	<b>Tokyo Subway Sarin Gas Attack 1995</b> Members of religious group Aum Shinrikyo released sarin gas in 5 places in Tokyo subway, killing 12 and injuring 6,000.	<b>Vioxx (1999-2004)</b> A nonsteroidal anti-inflammatory drug (NSAID) inhibitor for treatment of osteoarthritis and pain. Withdrawn because of risk of heart attack & stroke.													



# Inheriting The Future

- **Global Warming**
  - Burning Coal
    - Coal Waste
  - Mercury from Coal to Fish
  - Nuclear waste
  - Chemical body burden
  - Chemical use
  - Sustainability
  - LEAD !! (2017)



## Public Health and the Precautionary Principle

By Steven G. Gilbert



See: <http://healthlinks.washington.edu/nwcpfp/nph/nwph>

# Precautionary Principle

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**“When an activity raises threats of harm to human health or the environment, precautionary measures should be take even if some cause and effect relationships are not fully established scientifically.”**

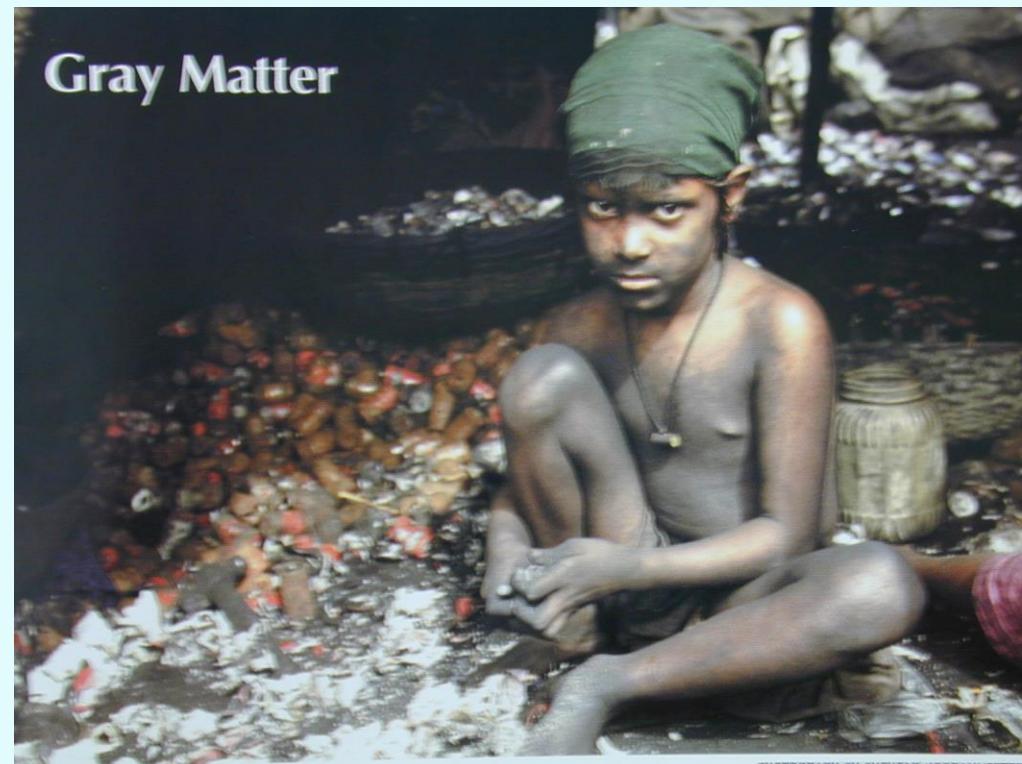
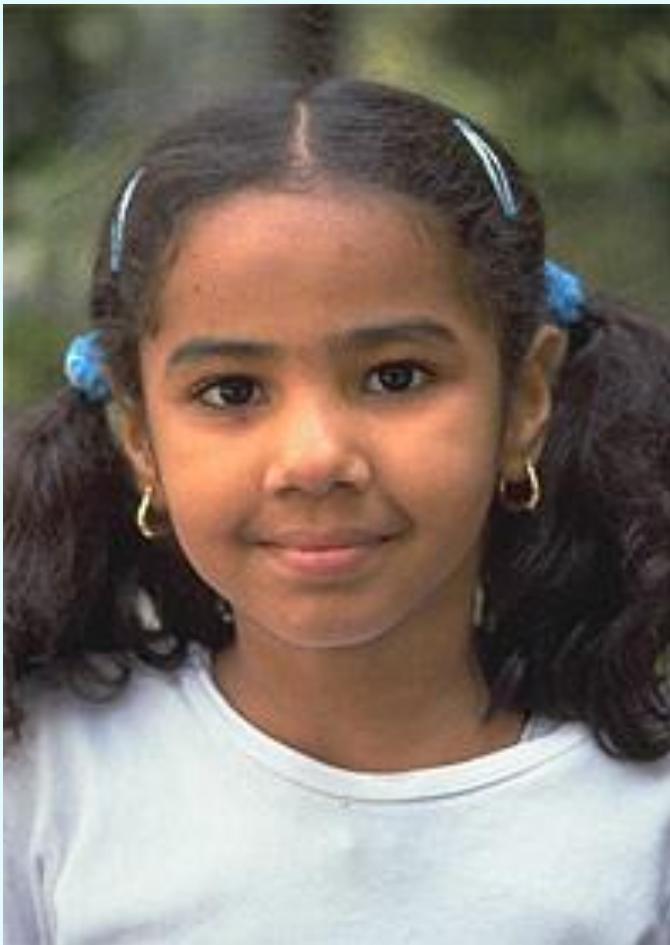
**Wingspread Conference, 1998.**

# Central components

- **Setting goals (Health indicators)**
- **Taking preventive action in the face of uncertainty**
- **Shifting the burden of responsibility to the proponents of an activity (Who benefits?)**
- **Exploring a wide range of alternatives to possibly harmful actions (Is it necessary?)**
- **Increasing public participation in decision making (transparency of information & environmental justice)**



# Child Health



# OSHA does what ?

The Occupational Safety and Health Administration (OSHA) is an agency of the United States Department of Labor. Congress established the agency under the Occupational Safety and Health Act, which President Richard M. Nixon signed into law on December 29, 1970.

<https://www.osha.gov>



# OSHA does what ?

OSHA's mission is to "assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance".

<https://www.osha.gov>



# OSHA and the States ?

OSHA's allows states to set up their own program and regulations as long they are as strict or stricter than OSHA.  
WA State took this option.



# L&I does what ?

Washington State Dept. of Labor & Industries. L&I is a diverse state agency dedicated to the safety, health and security of Washington's 2.5 million workers.

<http://www.lni.wa.gov>



# L&I does what ?

L&I's Division of Occupational Safety and Health (DOSH) administers the Washington Industrial Safety and Health Act (WISHA) law by developing and enforcing rules that protect workers from hazardous job conditions.

<http://www.lni.wa.gov>



# L&I does what ?

## Keep Washington safe and working

- Protecting the health and safety of workers
- Ensuring medical care and financial help for injured workers
- Protecting workers' wages, hours, breaks and more
- Protecting the public from unsafe work and economic hardship

<http://www.lni.wa.gov>

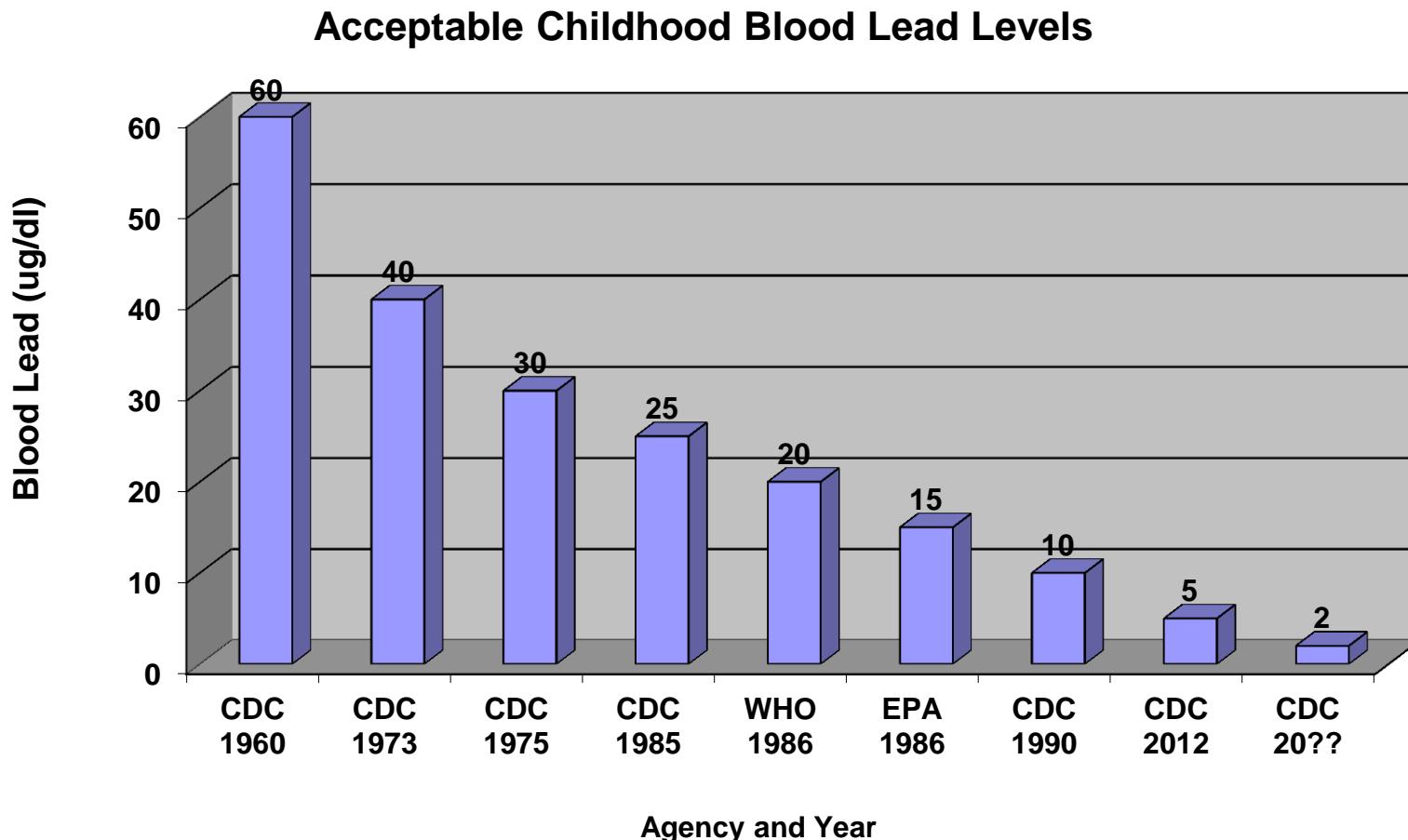


# Existing Inadequate Workplace Standards

OSHA regulates workplace lead exposure through two standards, the **general industry standard** and the **construction standard**. Both of these are based on scientific and medical evidence from the 1970s and do not reflect updated information regarding the hazards of low level lead exposure.



# Agency Blood Lead Levels



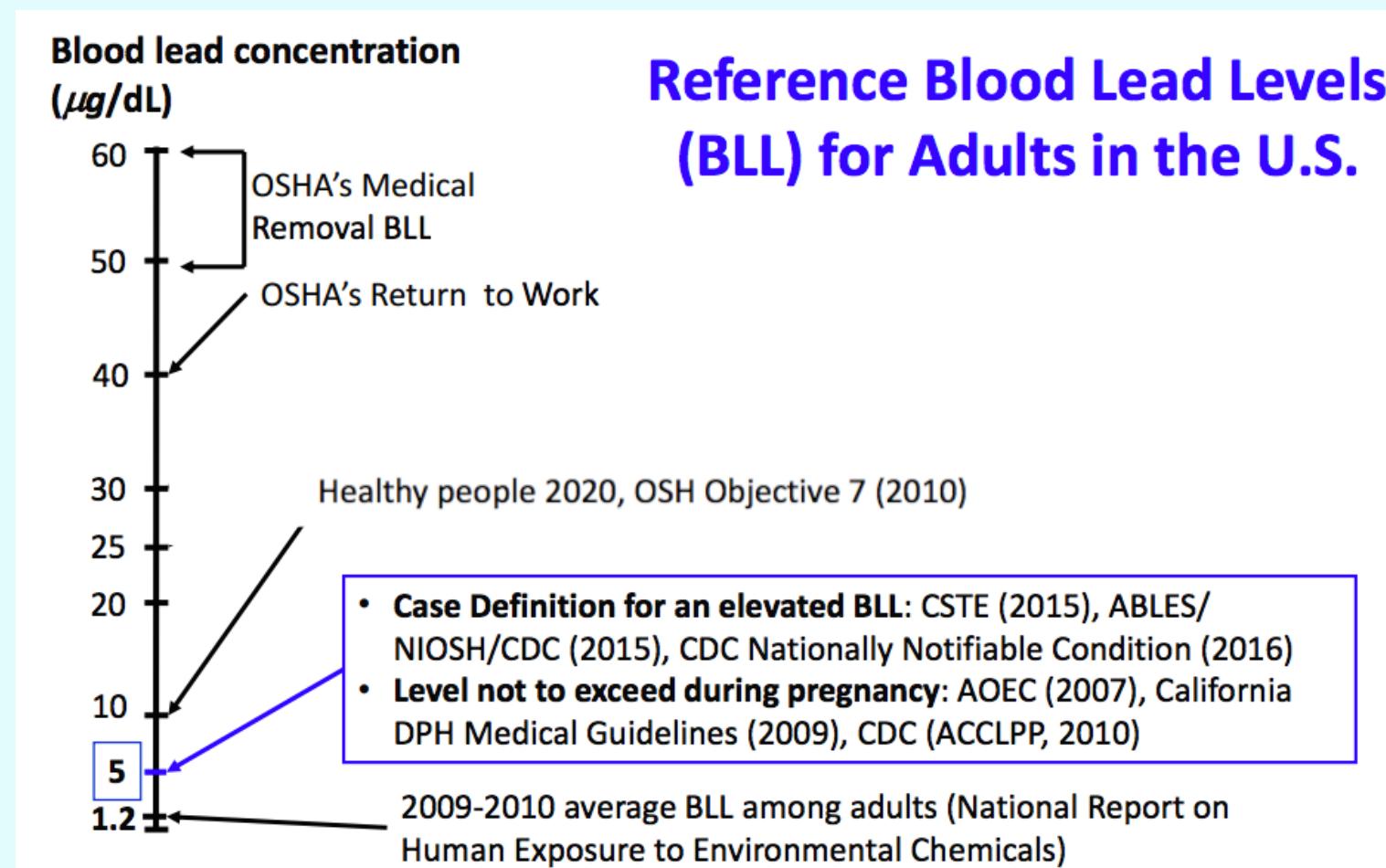
# Existing Inadequate Workplace Standards

Examples of key inadequacies of the current standards:

1. Exposures of lead that result in up to 60 µg/dL BLLs (or an average of 50 µg/dL BLL on three or more tests) are allowed before medical removal is required
2. Workers can return to work when BLLs are as high as 40 µg/dL
3. The permissible enforceable limit (PEL) is set at 50 µg/m<sup>3</sup> over 8 hours, which allows for BLLs as high as 60 µg/dL
4. Reliance on air lead levels as entry condition for the occupational lead standard ignores the role of ingestion in worker lead exposure



# BLL for adults



# Industries reporting the highest percentage of BLLs > 25µg/dL among workers

Manufacturing	Construction	Services	Mining
Storage battery manufacturing	Painting and wall covering contractors	Remediation services	Copper, nickel, lead, zinc mining, gold
Alumina and aluminum production and processing	Highway, street, and bridge construction	Amusement and recreation services	
Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying	Residential building construction	Automotive, mechanical, and electrical repair and maintenance	



# **Industries with commonly reported family lead exposure**

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**Lead smelting**

**Battery manufacturing/recycling**

**Radiator repair**

**Electrical components manufacturing**

**Pottery/ceramics**

**Stained glass making**

**Carpentry / remodeling / furniture repair**

**Fishing sinkers**



# Firing ranges and shooting

**About 1 million U.S. law enforcement officers train at indoor ranges, while 20 million citizens engage in target shooting as a leisure activity; as of 2011 there were about 270 million civilian-owned firearms in the U.S.**

**The National Sport Shooting Foundation (NSSF) stated that in 2011 in the United States there were 13,049,050 handgun shooters, 13,170,417 rifle shooters, 9,713,033 shotgun shooters, and 3,730,567 muzzleloader shooters**

**US shooting ranges at 16,000 to 18,000 as of 2013**

Laidlaw, M.A.S., Filippelli, G., Mielke, H. et al. Lead exposure at firing ranges—a review Environ Health (2017) 16: 34. doi:10.1186/s12940-017-0246-0

# Worker populations of particular concern

## What is a Worker ???

Younger workers ages 14-21

Organ systems are still developing

Neurological systems especially vulnerable

Women of reproductive age

Implications for fetal & child exposures

Ethnic/minority groups:

Disproportionate exposures based on job patterns

May have inadequate understanding of risks because of language barriers



## Take-Home Lead Exposure: Estimated Risks to Children

- OSHA estimates of workers exposed to lead:
  - General industry: 804,000 workers
  - Construction industry: 838,000 workers
  - *Not included: potential exposure through firing/shooting ranges*
- Estimates of child exposures from take-home lead (based on Roscoe et al 1999):
  - If we assume that 10% of all workers take lead home to their families, then 160,000 families affected by occupational lead exposure
  - If we assume that one child per family is affected, then 160,000 children might be exposed through take-home lead exposure from the workplace

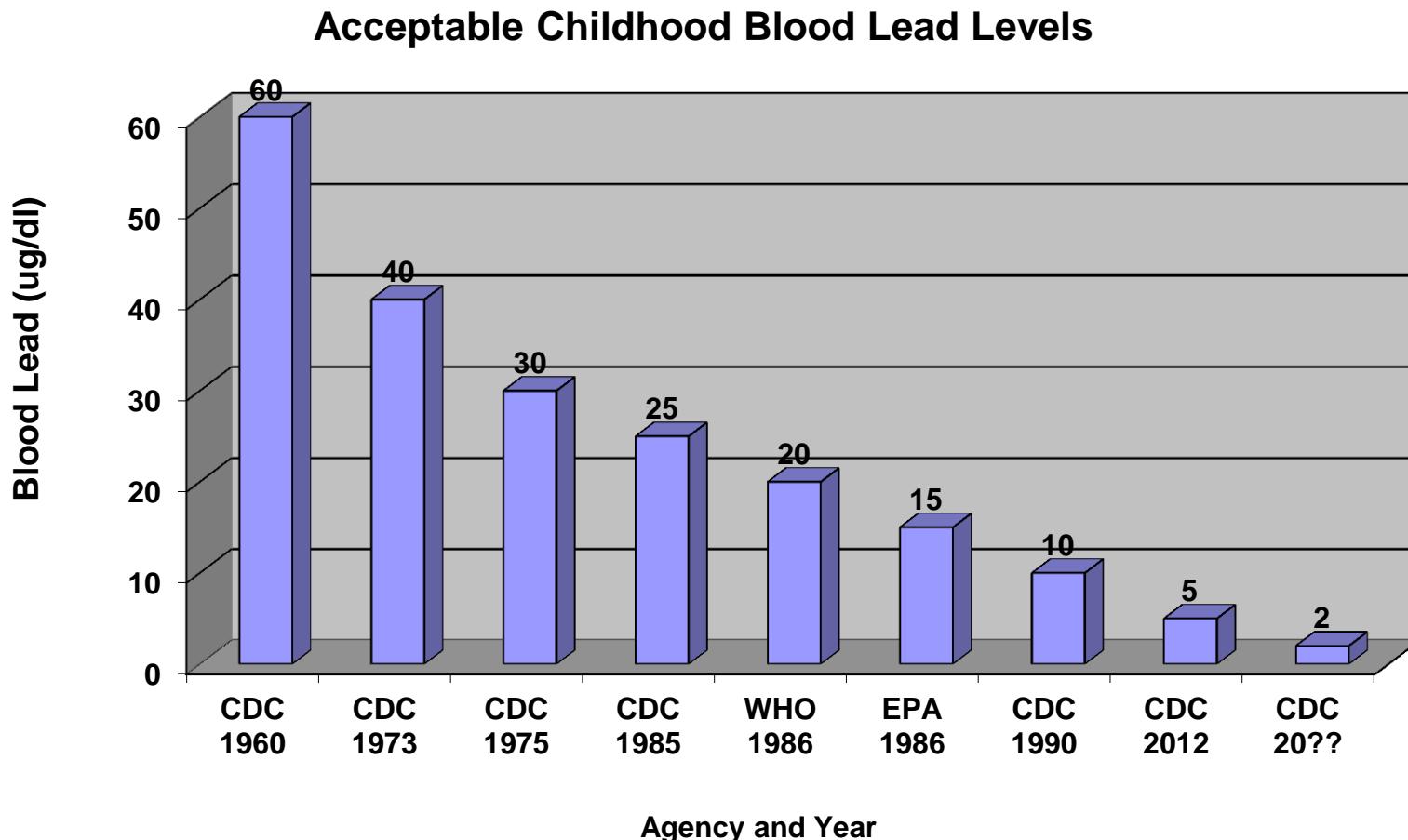


# Kids Not Little Adults

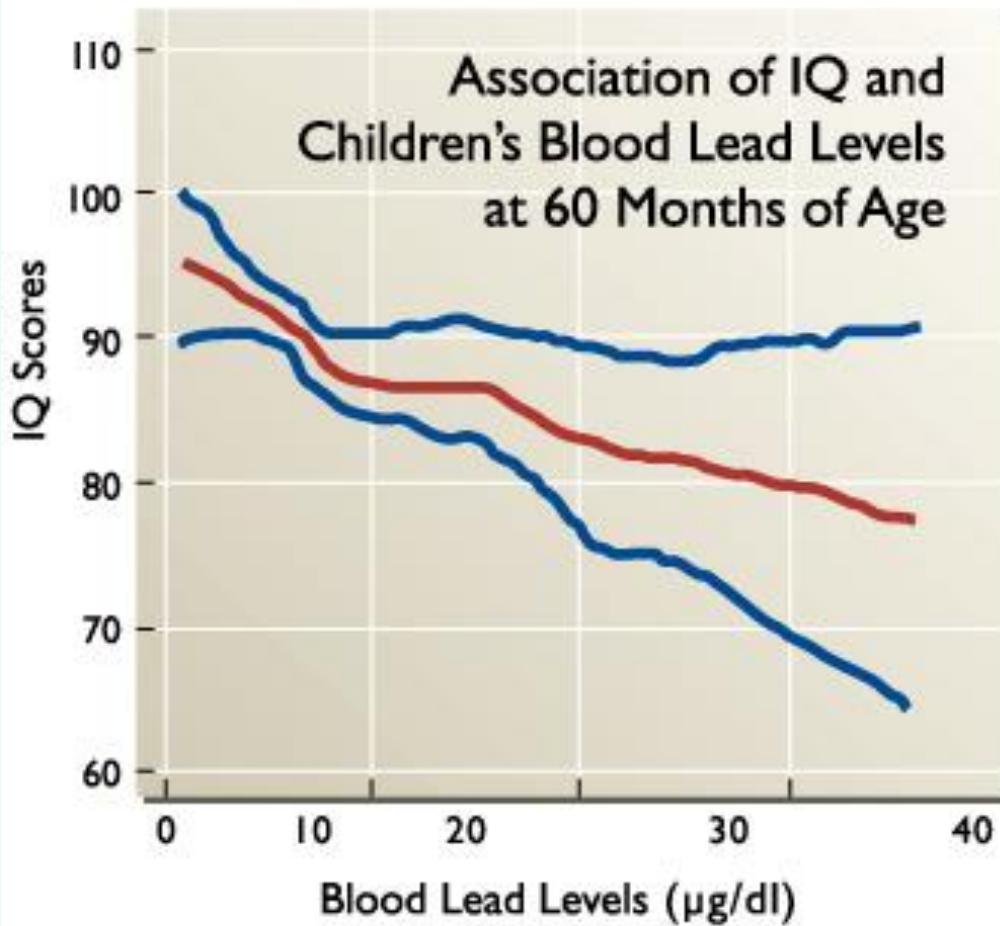
- 1. Are smaller – small exposure is a big dose**
- 2. Eat more by body weight**
- 3. Drink more by body weight**
- 4. Breath more**
- 5. Unique behaviors – hand to mouth**
- 6. Developing brain and other organs**



# Agency Blood Lead Levels



# IQ and Blood Lead



Canfield R, et al. NEJM 2003;348:1517-1526. (slide from BL)



A Small Dose of Toxicology

Occupational lead 06/08/17

# Conclusions & Recommendations

1. Current occupational lead standards **are not protective for workers and their families.**
2. Occupational lead standards should be updated to **prevent BLLs greater than 5 µg/dL in all workers**, in accordance with current scientific and medical evidence. This change would eliminate the arbitrary distinction between workers and children.
3. Children of workers exposed to lead on the job should receive **regular BLL screening**
4. **CDC acknowledges that there is no safe level of lead.** We have an ethical responsibility to protect workers and children from known hazards such as lead.



# **Lead 10 to 2**

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## **Rationale for Lowering the Blood Lead Action Level From 10 to 2 µg/dL**

**Steven G. Gilbert and Bernard Weiss**

**Neurotoxicology Vol 27/5, September 2006, pp  
693-701.**

**<http://dx.doi.org/10.1016/j.neuro.2006.06.008>**



# Project TENDR

## Recommendations

**Project TENDR recommends that the US government adopt the following national goals: ensure that, by 2021, no child has a blood lead level greater than 5 µg/dL and, by 2030, no child has a blood lead level greater than 1 µg/dL.**

Project TENDR: Targeting Environmental Neuro-Developmental Risks. The TENDR Consensus Statement. Environmental Health Perspectives. Vol. 124:7 July 2016.

Bellinger DC, Chen A, Lanphear BP. Establishing and Achieving National Goals for Preventing Lead Toxicity and Exposure in Children. *JAMA Pediatr.* Published online May 15, 2017.  
doi:10.1001/jamapediatrics.2017.0775



# Lead – Global Issue

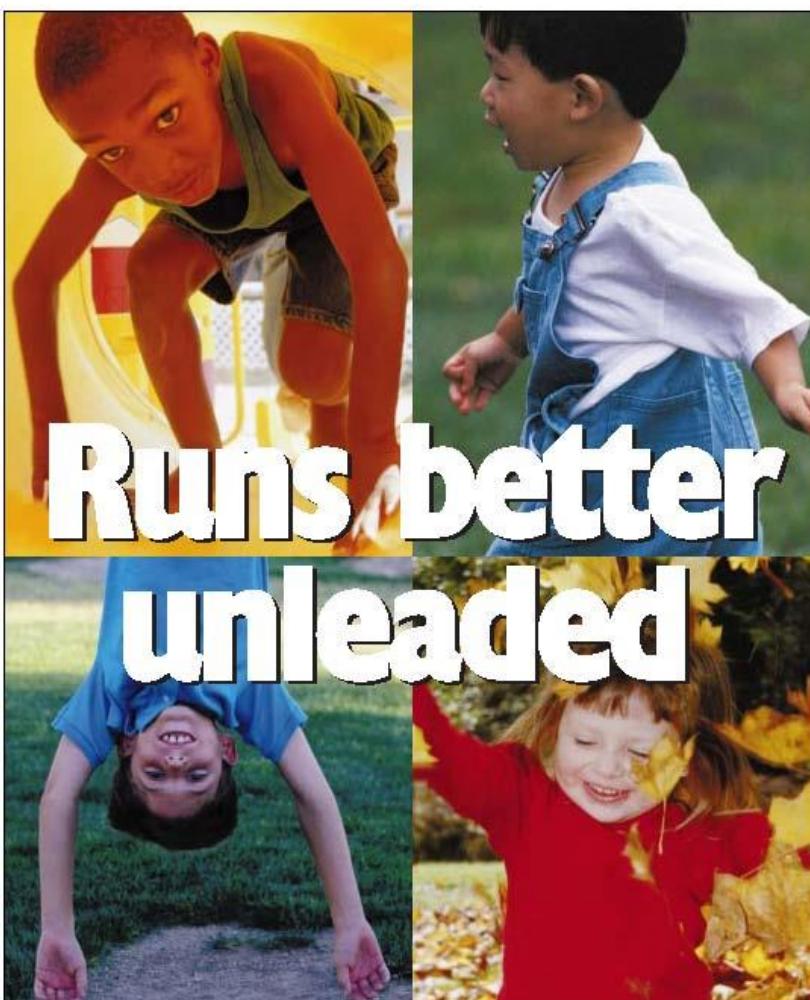
## Childhood Lead Exposure May Cost Developing Countries Nearly \$1 Trillion

**Results: We estimated a total cost of \$977 billions of international dollars in low- and middle-income countries, with economic losses equal to \$134.7 billion in Africa, \$142.3 billion in Latin America and the Caribbean, and \$699.9 billion in Asia. total economic loss in the range of \$728.6–1162.5 billion.**

Attina TM, Trasande L. 2013. Economic costs of childhood lead exposure in low- and middle-income countries. Environ Health Perspect 121:1097–1102; <http://dx.doi.org/10.1289/ehp.1206424>



# Runs Better Unleaded



U.S. Environmental  
Protection Agency  
EPA-747-H-98-002

For more information on preventing lead poisoning  
call 1-800-424-LEAD or visit [www.epa.gov/lead](http://www.epa.gov/lead).



# A Small Dose of Lead

