

# LEAD 101: LEAD POISONING BASICS

Ellen Bloom, MPH, CHES

Indiana State Department of Health

Lead and Healthy Homes Program

# Agenda

- Lead Basics
- Lead Use in History
- Sources of Lead
- Routes of Exposure
- Risk Factors
- Testing Requirements
- Common Symptoms
- Lead in the Body
- Long-Term Effects
- Lead Poisoning in Indiana
- Housing
- Current Issues in Lead Poisoning
- References

# Lead Poisoning

Lead poisoning is the most common preventable disease in Indiana children.

# What is Lead?

- Common, dense heavy metal
- Useful in many industries
  - ▣ Battery production
  - ▣ Glass, crystal, and enamel manufacturing
  - ▣ Rubber production
  - ▣ Oil refinement



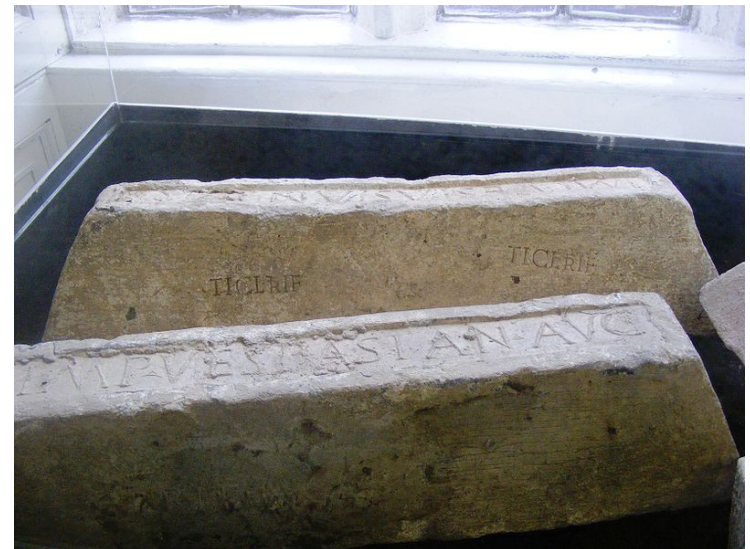
# Why is Lead Useful?



- Density
  - ▣ X-ray shields
- Malleability
- Resists corrosion
- Adheres well to surfaces
- Tastes sweet
  - ▣ Used in candy

# Lead Use in History

- Lead sculpture has been found in Turkey dating from 6400 BCE
- Romans were the largest pre-industrial producer of lead
  - ▣ Used in pipes, buildings, lining baths, coins and wine vessels
  - ▣ The word “plumbing” comes from the Latin word for lead, *plumbum*



# Lead Use in History

- Lead poisoning was one of the first occupational diseases to be recorded
  - ▣ Hippocrates, 370 BCE
- Symptoms of lead poisoning were recognized and documented by Romans and during the Middle Ages
- Used for face-whitening makeup
- Hot metal typesetting
- Paint
  - ▣ “Crazy as a painter”



# Lead Use in History

- Conditions described
  - ▣ “Saturnine gout:” A condition in ancient Rome caused by eating and drinking from leaded vessels
    - Exacerbated by excessive drinking
  - ▣ Colic in 17<sup>th</sup> c. German monks: Monks who drank alcohol were afflicted while others were not
    - The wines contained lead acetate
  - ▣ “Devonshire colic:” lead poisoning symptoms found in Devon residents who drank cider made in lead-lined presses

# T'owd Man, Derbyshire



# Lead Use in History

- Industrial Revolution
  - ▣ Lead poisoning became more common in occupational settings
- Childhood exposure
  - ▣ Increased with the introduction of residential lead paint in the 19<sup>th</sup> century
  - ▣ First recognized in Australia in 1897
- Lead added to gasoline beginning in the 1920s to reduce knocking
- Banned from paint in the U.S. in 1978, phased out of gasoline from the 1970s-1990s

# Primary Sources of Lead Exposure

- Paint
  - ▣ Chips, cracks, peels
  - ▣ Breaks down into dust
- Dust
  - ▣ Floors, windowsills, high-friction areas, home renovation
- Soil
  - ▣ Paint chips
  - ▣ Exhaust from leaded gasoline



# Secondary Sources

- Vinyl mini-blinds
  - ▣ Produced outside the U.S.
- Ammunition
- Car batteries
- Fishing weights
- Occupational sources
- Toys
- Pottery
- Plastic
- Hobbies
  - ▣ Pewter
  - ▣ Stained glass
- Water
- Jewelry
- Food storage containers
- Folk and ethnic remedies and cosmetics



Azarcon

Greta

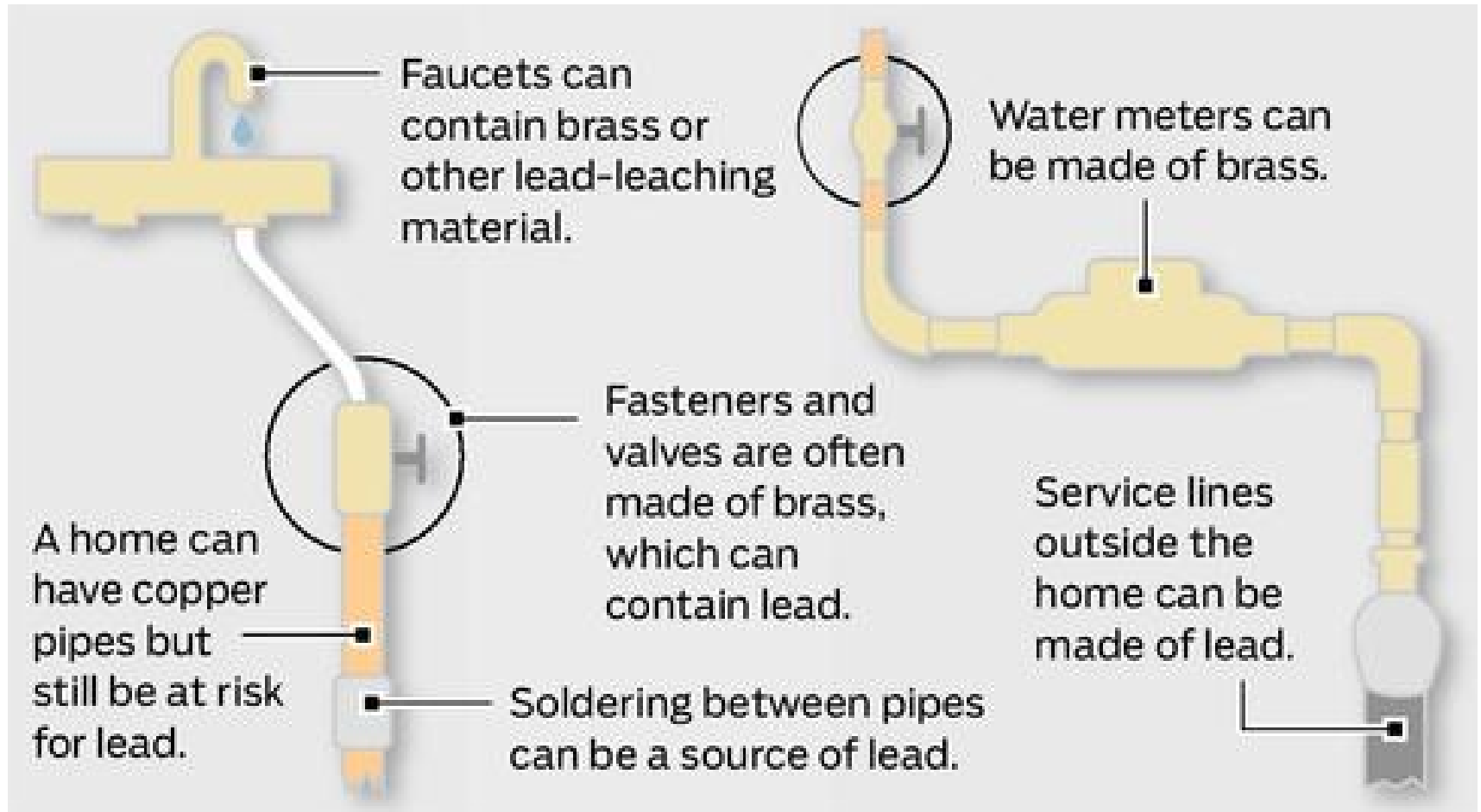


# Industrial Sources



- Battery production/repair
- Highway repair (bridges)
- Street painters
- Water pipes
- Soldering plants/smelters
- Radiator production/repair
- Ceramics
- Scrap metal/junkyards
- Shooting ranges
- Construction

# Water



SOURCE: U.S. and Illinois EPA

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# Routes of Exposure

## □ Ingestion

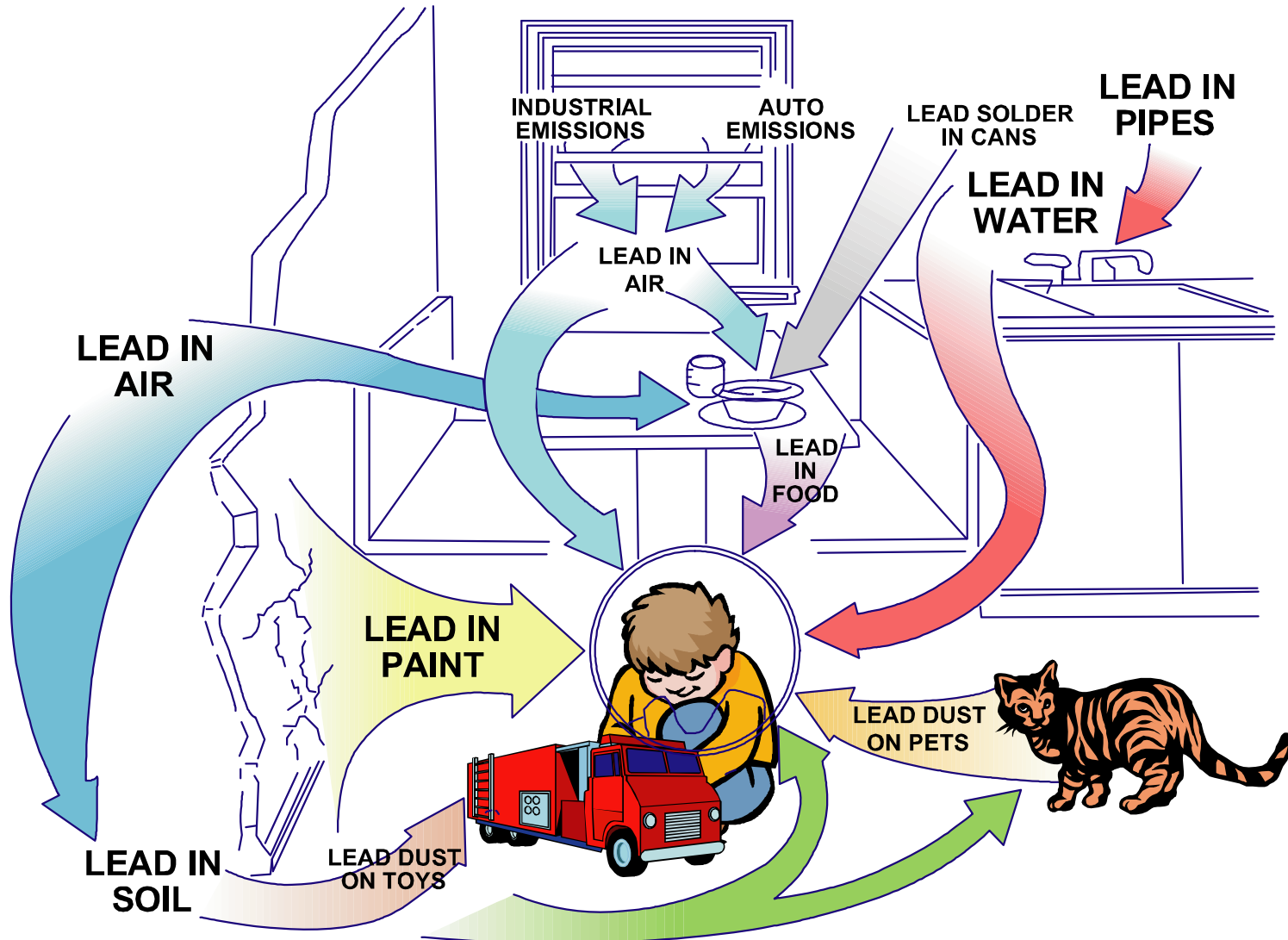
- ▣ Mouthing leaded objects
- ▣ Contaminated food, water, medicine
- ▣ Lead particles on hands transferred to food
  - Hand to mouth activity in children

## □ Inhalation

- ▣ Lead dust
- ▣ Fumes



# Environmental Sources of Childhood Lead Exposure



# Why are Children at Higher Risk for Lead Poisoning?

- Frequent hand to mouth activity
- Spending time on the floor
- Chewing on surfaces
- Bodies, brains, and immune system are still developing
  - ▣ More susceptible to toxins
  - ▣ Absorb more lead pound for pound than adults



# Risk Factors

Living in or regularly visiting a house or childcare center built before 1978

Having a sibling or playmate who is lead poisoned

Coming in contact with someone who works in an industry that uses lead

Coming in contact with someone who has a hobby that uses lead

Being a recent immigrant from a country where lead use in consumer products is not regulated

Belonging to a minority group

Being enrolled in Hoosier Healthwise

Using traditional or folk remedies that may contain lead such as azarcon or greta

Using traditional or folk cosmetics that may contain lead such as kohl

# Testing Requirements

- Federal and state law mandate that 100% of Medicaid-eligible children must be tested for lead
  - ▣ Tests at ages one, two, and three to five if not tested previously
- It is recommended that children who are not eligible for Medicaid be tested if they have one or more risk factors

# Level of Concern

- 1960-1970: 60  $\mu\text{g}/\text{dL}$  (micrograms per deciliter)
- 1970-1985: 30  $\mu\text{g}/\text{dL}$
- 1985: Level lowered to 25  $\mu\text{g}/\text{dL}$
- 1991: Level lowered to 10  $\mu\text{g}/\text{dL}$  (current level of concern)

**There is no safe level of lead in the body.**

# Common Symptoms of Lead Poisoning

- Fatigue
- Sleep problems
- Dizziness
- Irritability
- Nervousness
- Headaches
- Difficulty concentrating
- Depression
- Forgetfulness
- Hyperactivity
- Numbness
- Wrist or foot drop
- Clumsiness
- Joint or muscle pain
- Vomiting
- Loss of appetite
- Stomachache
- Constipation
- Metal taste in mouth

# However. . .

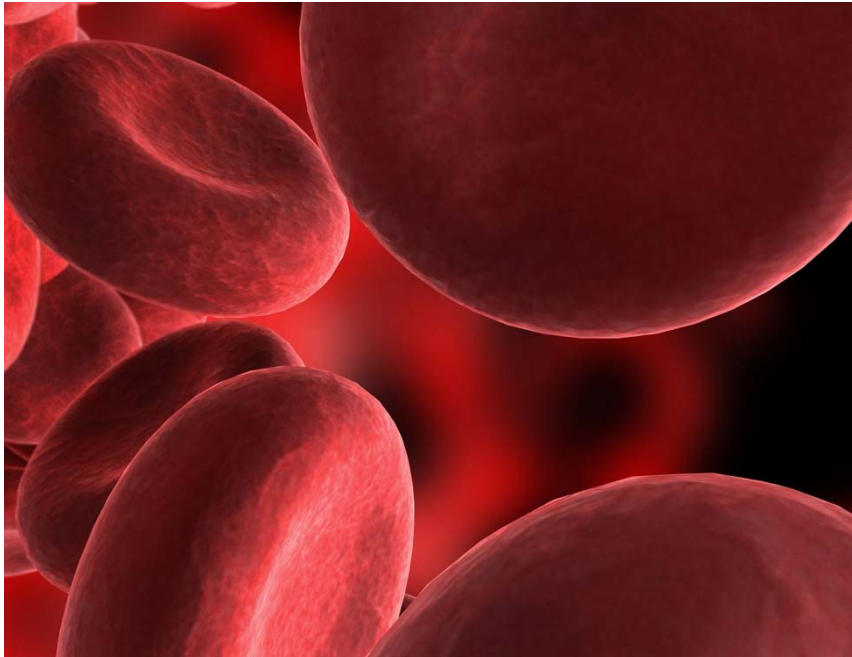
- Most children who are lead poisoned do not have any symptoms
- The **ONLY** way to tell if a child has been lead poisoned is to get a blood lead test



# Lead in the Body

- Children absorb about 50% of the lead they ingest
  - ▣ Adults absorb 10-15%
  - ▣ Iron deficiency, calcium deficiency, and a fasting state can all enhance gastrointestinal absorption
- About 70% of inhaled lead is absorbed
- Lead is distributed into blood, bone, and soft tissues

# Lead in the Blood



- Blood lead level represents about 5-10% of the total body burden of lead
- Half-life: 35 days
- Lead is found in red blood cells
  - ▣ Importance of iron

# Lead in Soft Tissue

- About 10-20% of total body lead burden
- Half-life: 40 days
- Most toxic effects on the body
- The severity of the poisoning depends on child's age and length of exposure



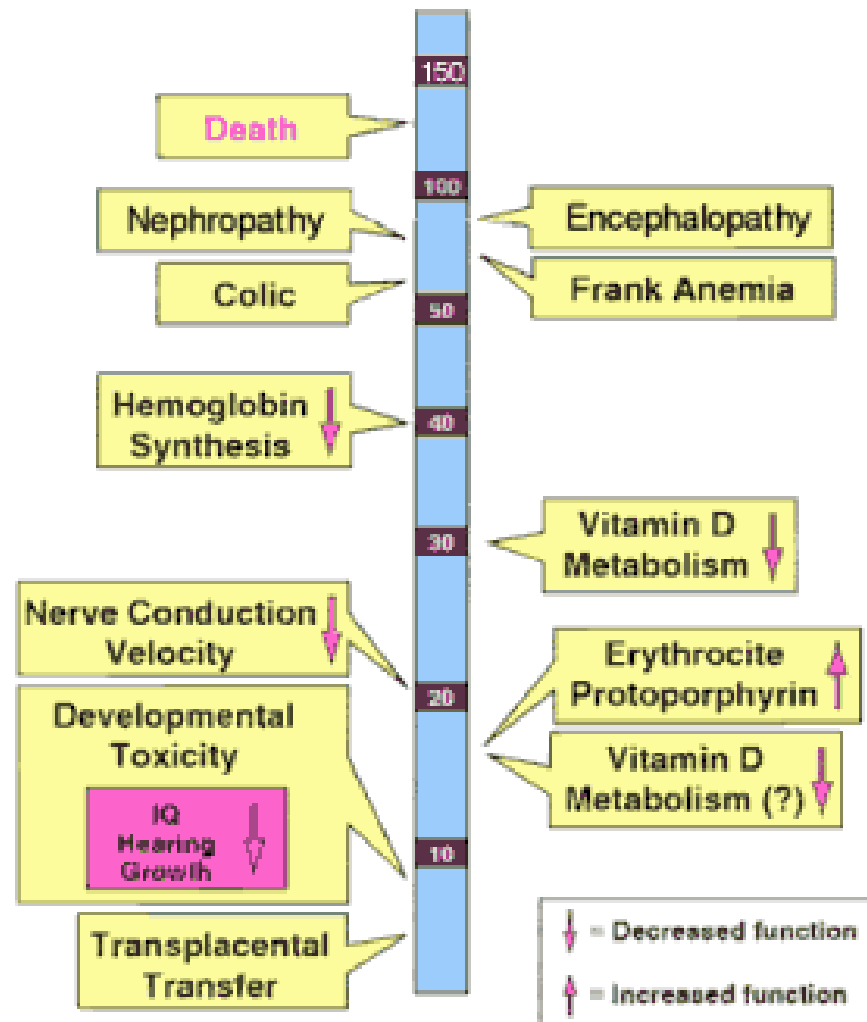
# Lead in the Bones

- About 70-85% of total body burden of lead
- Half-life: Up to 30 years
- As the blood lead level drops, lead will migrate from bone to blood
  - ▣ May be the cause of a prolonged elevated blood lead level
  - ▣ Migration can also occur during pregnancy in women with high bone lead levels

# Lead in the Body

- About 60% of absorbed lead is later eliminated from the body
- Primary routes of elimination:
  - ▣ Kidneys
  - ▣ Feces
  - ▣ Hair and nail growth
  - ▣ Sweat

# Effects of Lead Poisoning



# Long-Term Effects

- Childhood lead levels are linked to high rates of arrests and violent crime in adolescents and young adults
- Lead levels are associated with aggressive, anti-social, and hyperactive behavior in school-aged children
- Researchers estimate that the 1970 Clean Air Act is responsible for one third of the drop in crime that occurred in the 1990s
  - CAA banned the use of leaded gasoline

# Long-Term Effects

- Children with high lead levels are more likely to need special education services
- More likely to drop out of high school
- Lead-linked ADHD: about 20% of ADHD cases in children ages 4-15 are linked to lead poisoning
  - Children whose mothers were exposed to lead in pregnancy and who smoked during pregnancy were eight times more likely than other children to have ADHD

# Long-Term Effects

- High lead levels in children under five are associated with lower cognitive functioning
- Children who had high lead levels at age four have lower reading and math scores
  - ▣ Some problems do not become apparent for several years
- Prenatal lead exposure leads to lower mental functioning by 24 months of age

# Lead Poisoning in Indiana



- There were 217 new cases of lead poisoning in Indiana in 2010 (children under 7 with a blood lead level of  $10 \mu\text{g}/\text{dL}$  or higher)
- About two-thirds of lead poisoned children in Indiana are Medicaid-eligible

# Lead Poisoning in Indiana

- Most cases occur in urban areas
  - ▣ Allen, Elkhart, Lake, Marion, Vigo, and Wayne Counties all had ten or more cases
  - ▣ These counties accounted for 65% of all cases in the state in 2010
- Highest rate, 2010: Marion County, 54 cases



# Indiana Housing

- The older the home, the greater the risk for lead hazards
- Indiana ranks 11<sup>th</sup> nationally in homes built before 1950
  - ▣ 28% of total housing units were built prior to 1950
  - ▣ 71% built before 1980 (Lead paint in homes outlawed in 1978)

# Housing

Construction Year	Percent Houses with Hazard
1978-1998	3
1960-1977	8
1940-1959	43
Before 1940	68

# Current Issues in Lead Poisoning

- Chinese provinces
  - ▣ Smelters and other industry
  - ▣ Problems getting tests, treatment, and information
  - ▣ Difficulty in obtaining accurate data
- Zamfara State, Nigeria
  - ▣ Gold ore processing
    - Lead runoff in water and air
  - ▣ An estimated 800 children died between March 2010 and March 2011
  - ▣ Mean BLLs of up to 119  $\mu\text{g}/\text{dL}$  have been found in children in some affected villages

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# Questions

- Ellen Bloom, MPH, CHES  
Health Educator  
Indiana Lead and Healthy Homes Program  
Indiana State Department of Health  
2 N. Meridian 5J  
Indianapolis, IN 46204
- Phone: 317-233-1290
- Email: [ebloom2@isdh.in.gov](mailto:ebloom2@isdh.in.gov)