



The Environmental And Health Impacts Of Lead Battery Recycling

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Global Lead Poisoning Epidemic

- The World Health Organization estimates that **240 million people** are overexposed and **99 %** of those with blood levels above 20 $\mu\text{g}/\text{dl}$ are in the developing world.
- Lead exposures account for **853,000 deaths** annually vs. 852,000 for all other occupational risk factors (or 1.1 million AIDS related deaths).
- Greatest burden is in low and middle income countries.



Are Elevated Blood Lead Levels (BLLs) Still A Problem?

| Country | Author/Year | Mean BLL $\mu\text{g}/\text{dl}$ | % greater than 10 |
|------------------------------|---|----------------------------------|-------------------|
| India | Kalra et al., 2013 | 5.3 | 12 |
| China | Xie et al., 2013 | 4.3 | 7.6 |
| South Africa | Naicker et al., 2013 | 7.9 | 25 |
| Democratic Republic of Congo | Tuakuila et al., 2013 | 11.5 | 71 |
| Thailand | Swaddiwudhipong et al., 2013 | 9.8 | 43.3 |
| Saudi Arabia | El-Desoky et al., 2013 | 5.2 | 17.8 |
| Nigeria | Ugwuja et al., 2014 | 8.7 | 33 |
| China | Hou et al., 2013 | 8.8 | NA |
| | Mean | 7.5 | 30.0 |
| USA | NHANES 2010/ GM 1.3 $\mu\text{g}/\text{dl}$ | NA | 0.8 |

Why Are Developing Countries More Susceptible To Lead Poisoning?

- More opportunities for exposure.
- Poor nutrition increases lead absorption.
- Higher proportion of children.
- Lack of infrastructure for battery collection and recycling.
- Few regulations on lead industries.
- Absence of health screening programs.

LEAD POISONING

Children with Low Level exposures:

- IQ deficits, lower school performance, lower scores on standardized tests,
- Behavior problems,
- Hearing deficits,

Adults:

- High blood pressure linked to heart disease and stroke;
- Reproductive system effects include miscarriages, preterm deliveries, low birth weight, miscarriages, & stillbirths.



Economic Costs Of Childhood Lead Exposure In Low and Middle-income Countries

- Total cost of \$977 billion dollars per year in low- and middle-income countries.
- Economic losses estimated at \$134.7 billion per year in Africa or 4 % of gross domestic product (GDP).

Source: 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>



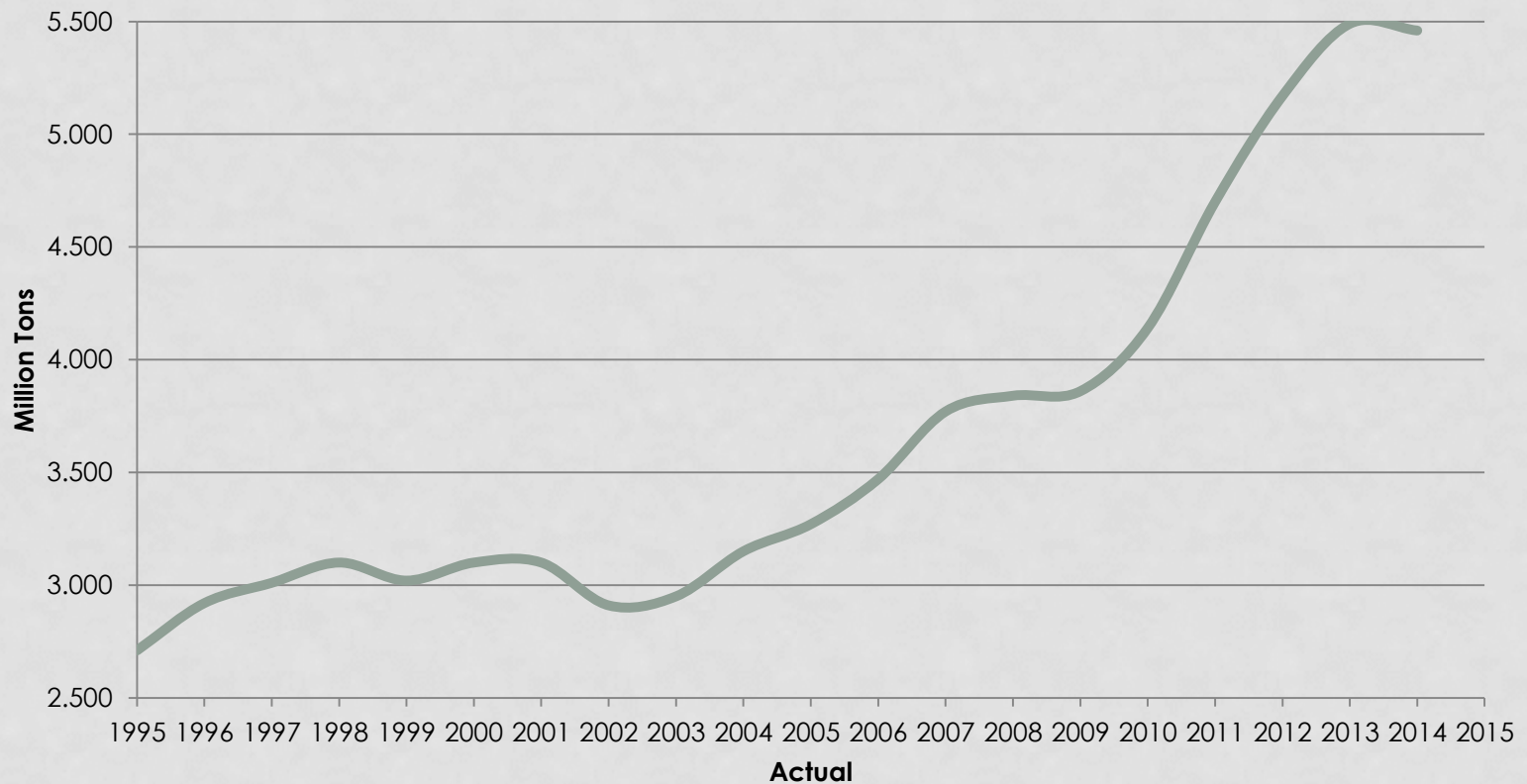
Recent Actions on Lead Poisoning Prevention

- In 2012 U.S. CDC eliminated the “level of concern” for **children** of 10 $\mu\text{g}/\text{dl}$ and instead adopted a reference value approach (currently **$>5 \mu\text{g}/\text{dl}$**);
- U.S. CDC/NIOSH 2015 changed the case definition for **adults** to level **$\geq 5 \mu\text{g}/\text{dL}$** (“nationally notifiable condition”).
- California updating occupational lead standard and proposed changing the airborne lead PEL from 50 $\mu\text{g}/\text{m}^3$ to 2.1 $\mu\text{g}/\text{m}^3$ (with goal to keep workers blood lead level below 10 $\mu\text{g}/\text{dl}$).



Global Mined Lead Production (1995-2014)

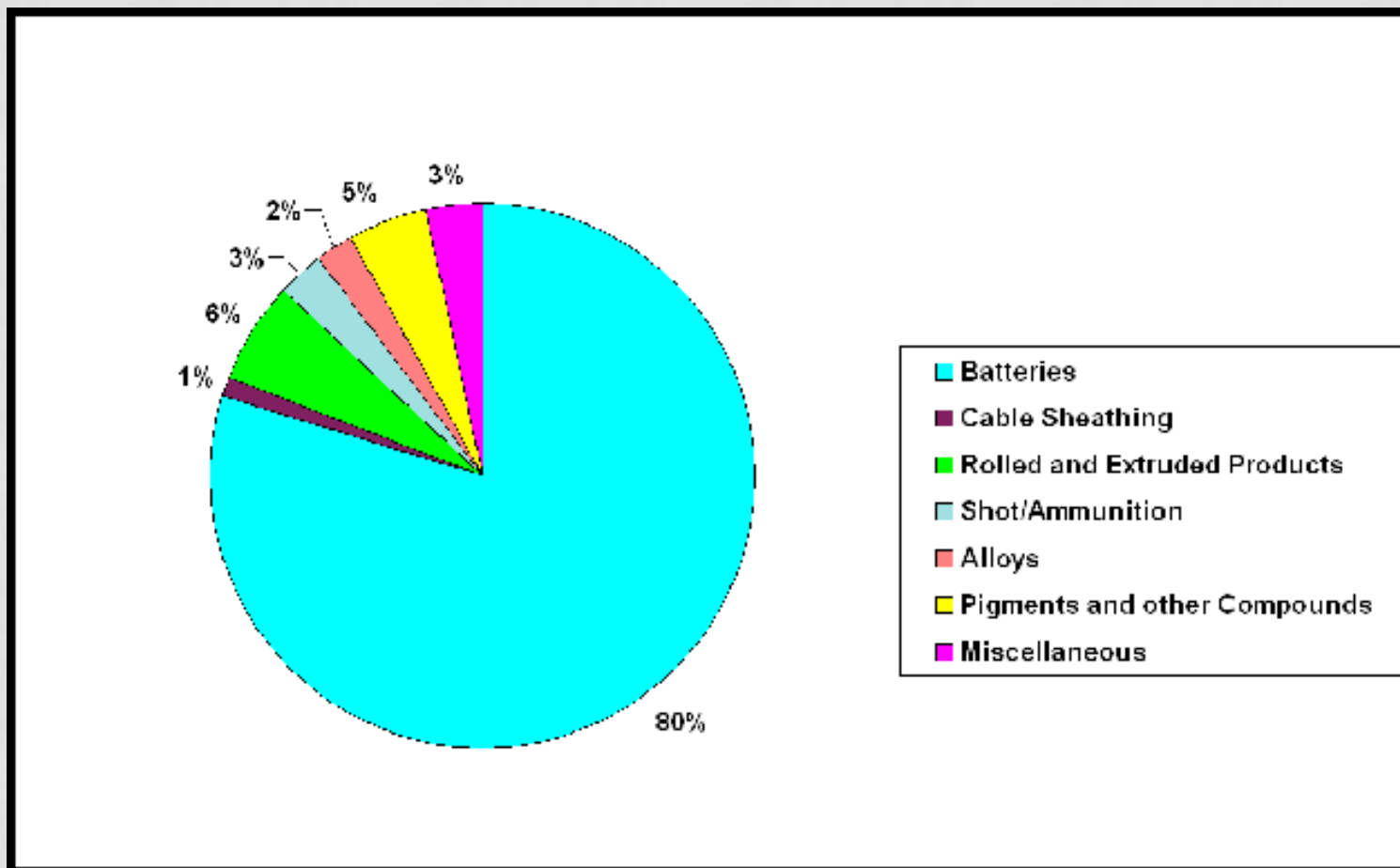
Global Mined Lead Production



Source: U.S. Geological Survey "Lead 2015"
<http://minerals.usgs.gov/minerals/pubs/commodity/lead/>



End Uses of Lead



Source: ILZSG, (5 year average)



Lead Battery Recycling

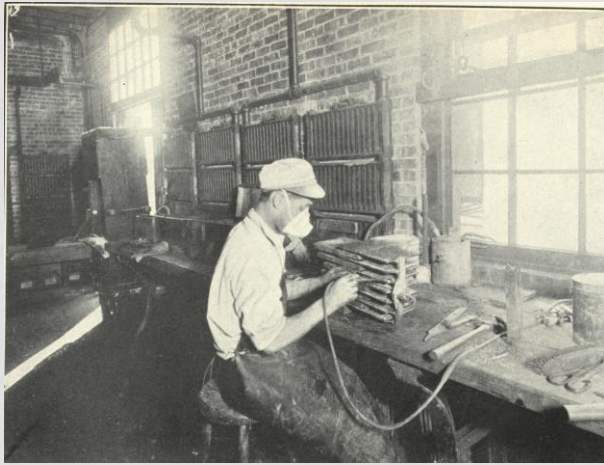


California Lead Battery Recycling Plant Ordered To Close



- Lead battery recycling plant outside Los Angeles ordered to close in 2015.
- Exide agreed to spend at least \$47 million dollars on cleaning up the site and contaminated properties up to 3 km away!
- Actual cleanup cost may exceed \$500 million dollars.

Lead Battery Manufacturing



1914



Today

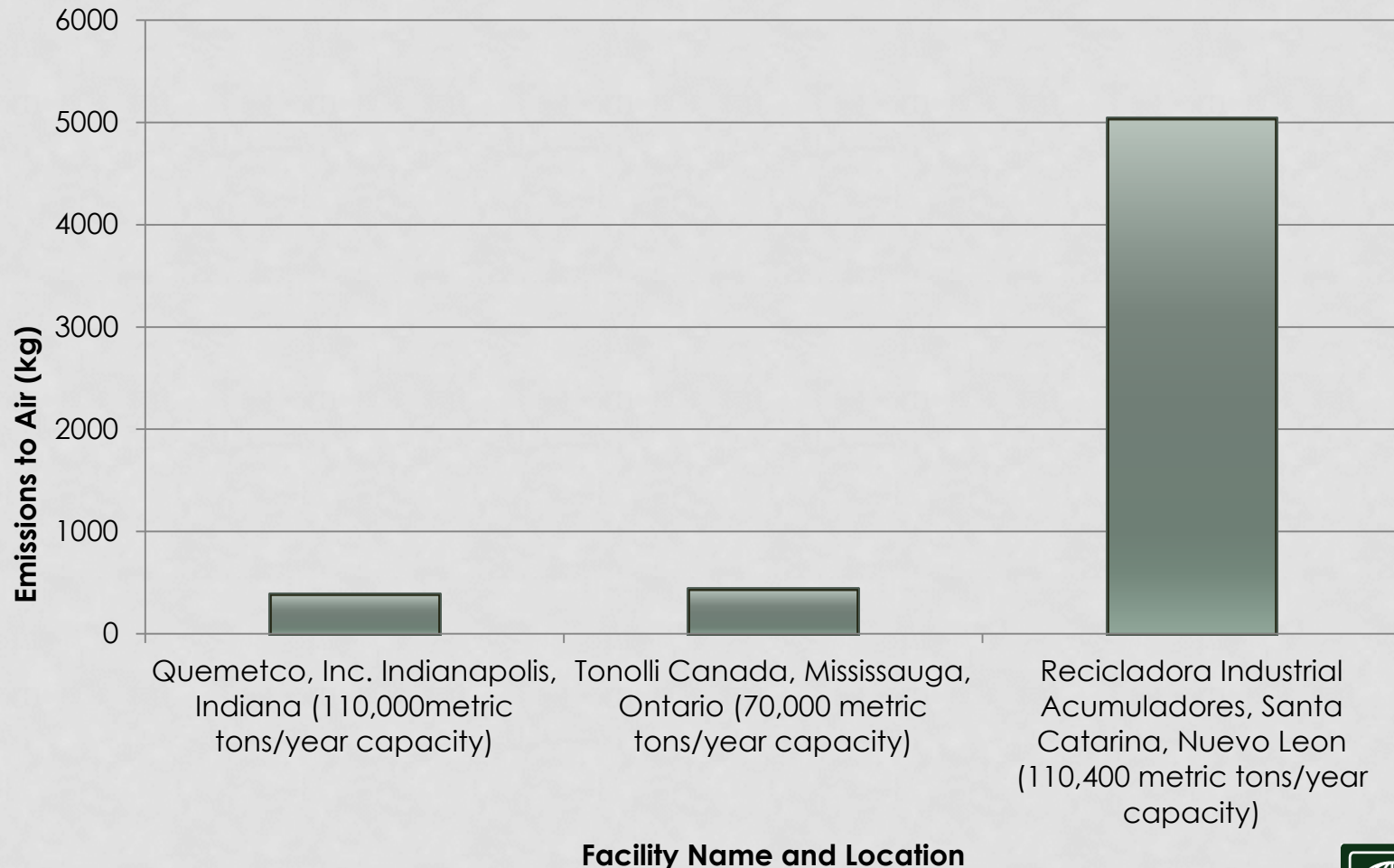
Welding battery plates together by melting lead with an open flame.

Source: “Lead Poisoning in the Manufacture of Storage Batteries” ,

Alice Hamilton, M.A., M.D., 1914



Lead Air Emissions From Recycling Facilities Reporting To Mexico, Canada and U.S. (2010)



Review Of Lead Battery Industry In Developing Countries From Studies Published (1993 - 2010)

- Average blood lead level in manufacturing plants was 47 ug/dl and 64 ug/dl in recycling facilities;
- Average air lead level was 367 ug/m³ or 7 times U.S. OSHA permissible level;
- Geometric Mean blood level among children living near plants: 19 ug/dl.

From: "Review: Lead Exposure in Battery Manufacturing and Recycling in Developing Countries and Among Children in Nearby Communities."
Gottesfeld, P. and Pokhrel, A., JOEH, 8:520-532 (2011).



Soil Lead Levels at African Lead Battery Recycling Plants

- Ongoing study by OK International's partners in 7 African countries (**including Nigeria, Cameroon, Ghana, Kenya, Mozambique, and Tunisia**);
- Soil sample results (to date) in locations outside of lead battery recycling plants range from < 40 ppm to 140,000 ppm (14%);
- **81%** of the soil samples analyzed to date have lead levels greater than 80 ppm and **64%** have soil lead levels greater than 400 ppm.



Why Must We Act Now?

- Lead battery consumption is growing.
- Few countries in Africa regulate the lead battery recycling industry.
- There are very few recycling plants with adequate emission controls.
- It will cost billions of dollars to deal with the legacy of lead contaminated soil and resulting poisoning cases unless we address this now!



Response Needed

- UN Agencies, the global health community and foundation funders should respond to this challenge;
- Build capacity for blood lead testing and health programs in all countries;
- All governments to require collection or take back programs for used lead batteries;
- Governments to mandate environmental and occupational standards for lead battery manufacturing and recycling industries.



WHEN WILL WE EVER LEARN?

“You will observe with Concern how long a useful truth may be known, and exist, before it is generally received and practiced on.”

Benjamin Franklin

“Letter on Lead Poisoning”

July 31, 1786





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