Global profile of Lead

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Background

Lead is a naturally occurring heavy metal:

- It is amenable to a range of uses.
- It accumulates and there are no safe levels.

Lead Acid Batteries

- The largest and increasing use of lead globally : > 85% in 2012 (ILA) motorization of emerging economies
- Recycling is predominant in many African countries: as the high lead content is economically attractive.

Global mine production

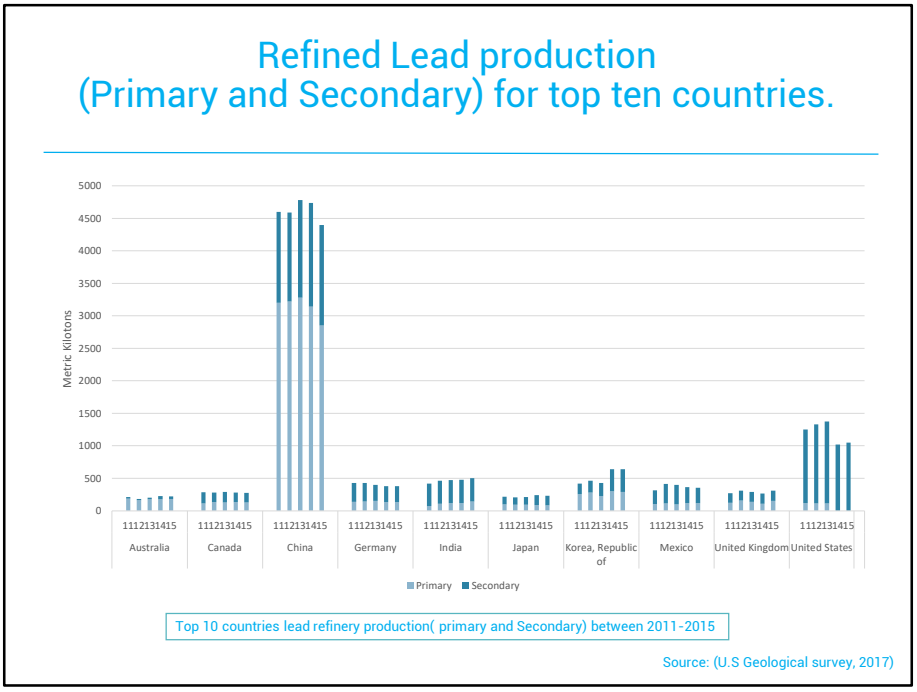
- About 4.6million mt (ILZSG, 2018) with recycling rates > 95%
- 54% of production is secondary globally: 74% Europe, 100% USA.
- USGS data suggest China accounted for 43% of global production of refined lead in 2015.

Lead is a naturally occurring blueish gray metal. Its chemical and physical characteristics, such as its malleability, low melting point and resistance to corrosion, make it amenable to a range of uses. Major applications include plumbing, food storage, cosmetics, batteries, and hundreds of others. Lead is also highly toxic to humans and the environment. Once taken into the body, it can cause permanent damage to the neurological and cardiovascular systems. These two intrinsic characteristics, its utility and toxicity, make lead one of the more ubiquitous and well-studied metals.

In many African countries, the recycling of lead-acid batteries is economically attractive because of its high lead-content. Due to inappropriate practices in most parts of Africa, the recycling of lead-acid batteries is assumed to have a negative impact on human health and the environment. In field studies on the lead-acid battery recycling chain in Ghana for example, it was found that “persons involved in collecting and transport of lead-acid batteries drain the contained acid prior to transport by opening the plugs or punching holes into the case. Due to the toxicity of lead and the sulfuric acid of the batteries, this causes massive lead contamination of soil and waterbodies.

Global mine production currently stands at about 4.6 million metric tons (International Lead and Zinc Study Group, 2018). Lead has one of the highest recycling rates of all commonly-used materials and is the highest among metals and can be recycled indefinitely

without reduction in quality. Accordingly, 54% of production is secondary globally, 74% in Europe, and 100% in US. China alone accounted for 43% of global production in



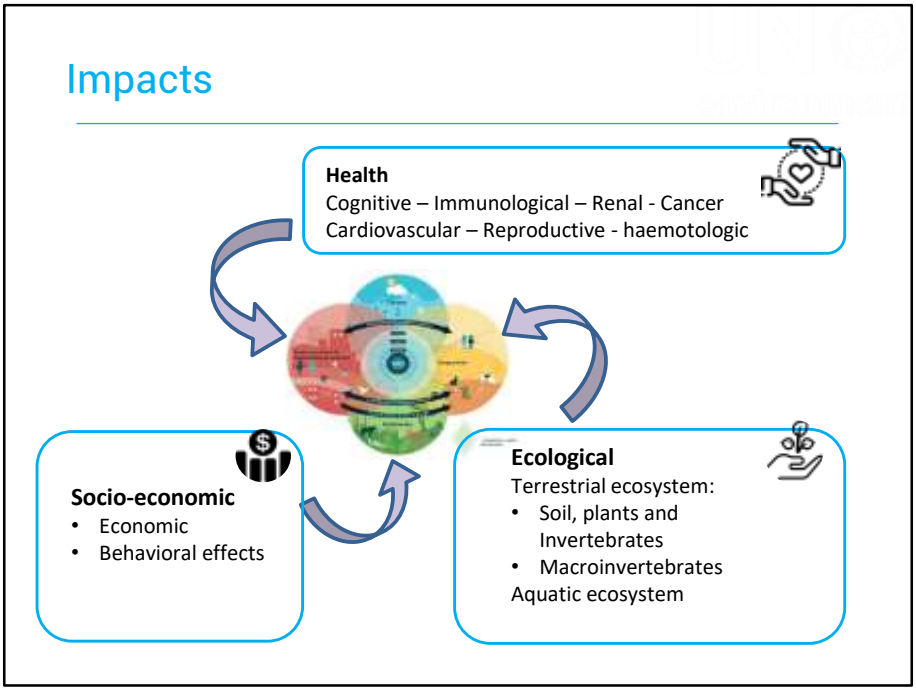
The chart above captures the ten countries with the highest lead refinery production, including both primary and secondary refining. China alone accounted for 43% of global production in 2015.

		Primary	Secondary	Total
Australia				
	11	187	26	213
	12	160	24	184
	13	177	24	201
	14	176	50	226
	15	182	41	223
Canada				
	11	113	170	283
	12	133	145	278
	13	129	159	288
	14	131	151	282
	15	128	145	273

China

	11	3200	1400	4600
	12	3220	1370	4590
	13	3280	1500	4780
	14	3140	1600	4740
	15	2850	1550	4400
Germany				
	11	136	293	429
	12	140	290	430
	13	151	249	400
	14	131	248	379
	15	130	248	378
India				
	11	72	347	419
	12	110	350	460
	13	116	355	471
	14	120	357	477
	15	143	358	501
Japan				
	11	100	117	217
	12	91	117	208
	13	95	115	210
	14	87	153	240
	15	85	147	232
Korea, Republic of				
	11	256	160	416
	12	280	180	460
	13	227	200	427
	14	299	340	639
	15	291	350	641
Mexico				
	11	101	216	317
	12	112	303	415
	13	100	300	400
	14	119	245	364
	15	116	240	356
United Kingdom				
	11	125	144	269
	12	157	155	312

	13	137	155	292
	14	110	157	267
	15	150	158	308
United States				
	11	118	1130	1248
	12	111	1220	1331
	13	114	1260	1374
	14	0	1020	1020
	15	0	1050	1050



HEALTH EFFECTS OF LEAD

Due to both their physiology and behaviors, children experience greater impacts of lead than adults. Young children are likely to engage in hand-to-mouth behavior and spend time on or near the ground, in contact with dust or soil. Children experience higher levels of absorption of ingested lead than adults and lead is retained in the body for a longer time . Furthermore, certain developing organ systems are more susceptible to the effects of lead. At present, about 1 % of the global disease burden is attributable to cardiovascular disease resulting from lead exposure (IHME, 2017). **CARDIOVASCULAR**

Recent research points to lead exposure as an overlooked contributor to cardiovascular disease in adults. cardiovascular disease mortality and ischemic heart disease mortality in adults was associated with blood lead levels below the threshold of 5 µg/. Increases in blood pressure and increases in the incidence of hypertension have both been consistently associated with elevated blood lead levels (United States Environmental Protection Agency, 2014). In fact, blood lead level has been identified as one of the most important risk factors for preeclampsia (maternal hypertension), a major contributor to maternal mortality.

COGNITIVE/NEUROLOGICAL

the most widely recognized human health impacts of lead are those affecting the brain. One such effect is impairment of cognitive function, as observed in reductions in IQ. This association is observed strongly in children. Increases in blood lead levels as low as 0.1-1.0

µg/dL are associated with the loss of one IQ point

REPRODUCTIVE/DEVELOPMENTAL
The impact of lead on human development has been most apparent in the delayed onset of puberty in both males and females (United States Environmental Protection Agency, 2014). Regarding reproductive health, there is historical evidence of occupational exposures affecting male fertility; the data point to impacts on sperm quantity and quality.

RENAL
The current body of evidence is suggestive of a causal relationship between lead exposure and reduced kidney function . Chronic low-level exposures to lead is considered a risk factor for chronic renal failure (Agency

HEMATOLOGIC
Based on epidemiological evidence and animal studies, lead has been found to be associated with a reduction in red blood cell survival and function (United States Environmental Protection Agency.

IMMUNOLOGICAL
The body of research on the impact of lead on the immune system points to two likely effects. The first is an increased prevalence of autoimmune diseases, such as inflammatory conditions like asthma. The second pathway, indicated by animal studies, is an interference with the body's ability to fight off bacterial and viral infections, resulting in decreased host resistance (United States Environmental Protection Agency, 2014).

CANCER
The International Agency for Research on Cancer classifies inorganic lead compounds as probable carcinogens (International Agency for Research on Cancer, 2018) .
TERRESTIAL ECOSYSTEMS: Beyond its impacts on human health, lead is also a well-documented ecotoxicant, posing threats to both marine and terrestrial ecosystems
6.1.1 SOIL, PLANTS AND INVERTEBRATES
Lead contamination in soil i can have detrimental effects on the soil microbial population and their diversity, which in turn affects soil matter transformation (Kushwaha et al., 2018). A high concentration of lead in soil also induces toxic effects on plants, including inhibition of germination and growth and reduction of transpiration and photosynthesis (Dogan, Karatas, & Aasim, 2018; Edelstein & Ben-Hur, 2018). In terrestrial organisms, the exposure pathway to lead can be direct ingestion (Rodríguez-Seijo et al., 2017). The main contributors of lead contamination in soil are: smelting, use of arsenate in horticulture and agriculture, combustion of petrol containing tetraethyl lead. Ammunition pellets also contribute to lead contamination in soil as the lead 7

6.1.2 MACROINVERTEBRATES
Lead contamination is also particularly known to impact a variety of bird species and pose a threat to biodiversity (Haig et al., 2014). Plaza and Lambertucci (2019the death toll of birds in

the U.S. alone reached 3 million before the lead ammunition ban (Plaza & Lambertucci, 2019). Birds get exposed to lead through various sources such as fishing sinkers, paint, atmospheric pollution, mining activities and most importantly, lead ammunition. In birds, the primary exposure pathway to lead is through ingestion (Haig et al., 2014) and once ingested, the toxic impacts range from subtle hematologic changes to serious and lethal pathologic alterations including nervous system alteration and death (Ferreyra et al., 2015; Haig et al., 2014).

6.2 AQUATIC ECOSYSTEMS

Lead contamination sources from metal production and manufacturing, sewage waste, remains from leaded gasoline and legacy issues namely, lead paint and lead contaminated water pipes (Aouini, Trombini, Volland, Elcafsi, & Blasco, 2018; International Lead Association, n.d.). Lead in the surface water eventually gets deposited in the sediments of rivers, estuaries and coastal areas; however due to varying conditions of physical properties and water chemistry in different water bodies, lead bioavailability levels also varies accordingly (International Lead Association, 2018).

Lead used in fishing tackles and spent ammunition are the most significant sources of lead exposure to fish and hence, to other organisms that consume the contaminated fish (Specht, Kirchner, Weisskopf, & Pokras, 2019). As lead uptake in fish is localized mostly in non-edible tissues of their bodies such as bones and scales, bioaccumulation of lead is seldom considered a significant issue. Lead contamination in aquatic organisms can damage membranes and inhibit the activity of essential enzymes. High concentration of lead also inhibits photosynthesis in algae hampering algae growth which could ultimately impact for the entire aquatic food chain (Solomon, 2008).

7.1 **ECONOMIC IMPACTS**

Lead exposure impacts economic growth by impeding brain development and diminishing an individual's earning potential. This happens both directly through reduced wages and indirectly through diminished educational attainment. Together these reductions result in overall losses in lifetime earnings for an individual. USD 12,700 to 17,200 (in 2002 USD) (Salkever, 1995; J. Schwartz, 1994).

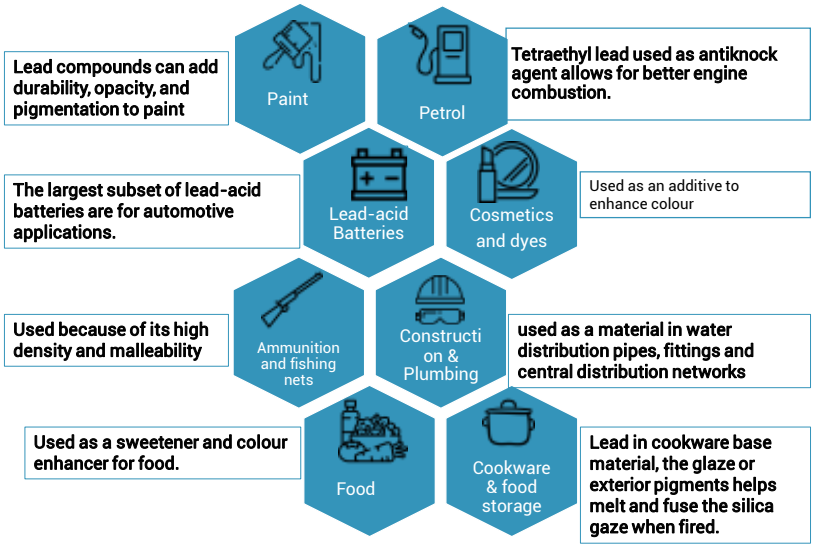
Attina and Trasande (2013) used this approach to estimate the economic burden of pediatric lead exposure in LMICs, weighting the model by country specific growth rates. In their study they found that nearly USD 1 trillion in lifetime earnings for their cohort were lost as a result of that exposure, or 1.88–4 % of GDP in the countries studied.

7.2 **BEHAVIORAL EFFECTS**

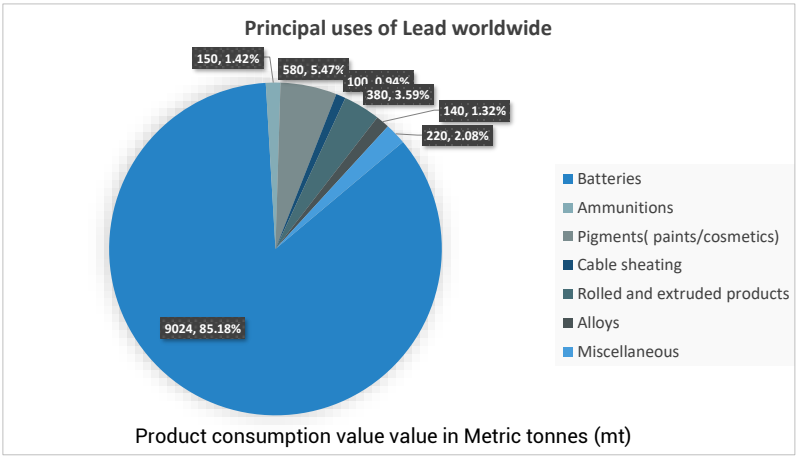
A number of studies have identified associations between anti-social behavior and lead exposure (Mielke & Zahran, 2012; Nevin, 2000; Taylor, Forbes, Opeskin, Parr, & Lanphear, 2016). Here too, the hypothesis is that lead impedes brain growth and that the subsequent neurological decrement results in hyperactivity and lack of impulse control manifested in antisocial acts (Mielke & Zahran, 2012). It is important to note that the vast majority of people with reduced neurological capacity do not commit crimes, however when viewed at a

societal level decreased IQ has been consistently associated with increased criminal or antisocial behavior.

Uses of Lead


Lead compounds can add durability, opacity, and pigmentation to paint
Paint
Petrol
Tetraethyl lead used as antiknock agent allows for better engine combustion.
The largest subset of lead-acid batteries are for automotive applications.
Lead-acid Batteries
Cosmetics and dyes
Used as an additive to enhance colour
Used because of its high density and malleability
Ammunition and fishing nets
Constructi on & Plumbing
used as a material in water distribution pipes, fittings and central distribution networks
Used as a sweetener and colour enhancer for food.
Food
Cookware & food storage
Lead in cookware base material, the glaze or exterior pigments helps melt and fuse the silica gaze when fired.

Lead use statistics



Source: (ILA, 2012)

Uses	Quantity(mt)
Batteries	9024
Ammunitions	150
Pigments(paints/cosmetics)	580
Cable sheating	100
Rolled and extruded products380	
Alloys	140
Miscellaneous	220

UN Environment's work

Mandate

- **From GC to UNEA 3/9 resolution:**
  - Mobilize resources; advancing implementation of the MEAs as well as SAICM.
  - Undertake capacity building activities to assist countries in implementing policy and strategic actions for the ESM of chemicals by
    - Convening and participating in partnerships
    - Developing, sharing technical and policy tools
    - Raising awareness - jointly with Secretariat of the Basel Convention.
    - Providing training and advise for policy development to aid development of new or improved policies or legislations to tackle ESM of chemicals.

- Assist countries in eliminating the use of lead paint, under the leadership of the Global Alliance to Eliminate Lead Paint and the World Health Organization, in particular by providing tools and capacity-building for developing national legislation and regulations, and to work regionally, where appropriate.
- Continue to assist countries, in particular developing countries and countries with economies in transition, in their efforts to strengthen and enhance the national, sub regional and regional implementation of environmentally sound management of waste, including by providing further capacity-building with respect to waste lead-acid batteries to implement regulatory frameworks and programmes for recycling, and better track and trace shipments, in close cooperation with the Secretariat of the Basel Convention.

Lead in Paint

Partnership

- Voluntary
- Led by UNEP and WHO
- 90 partners
- Guided by an Advisory Council

Knowledge

71 out of 194 countries (36.5%) have legally binding controls to limit the production, import and sale of lead paint

Implementation

- *Model Law and Guidance to Regulate Lead Paint* (all UN languages)
- GEF-funded SAICM project lead in paint component

Infrastructure

- industry & National Cleaner Production Centres developing Paint reformulation using lead free additives.

Awareness

- Civil Society Global campaigns
- Annual International Lead Poisoning Prevention Week
- Bi-monthly News letter

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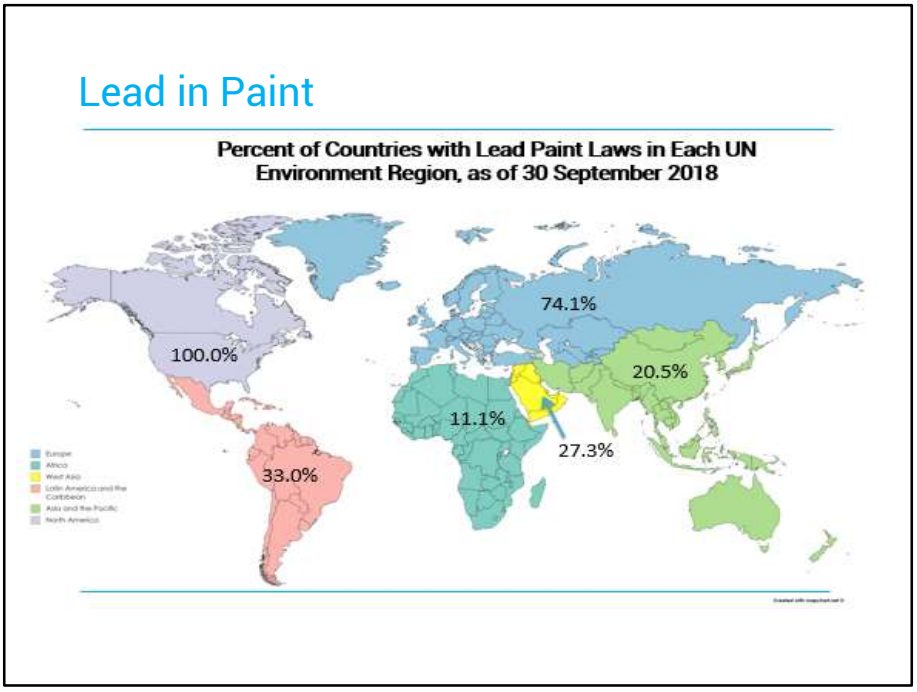
Lead in Paint



Many countries were actively supported by the Lead Paint Alliance in drafting lead paint laws. By region, the number of countries with lead paint laws with percentages in relation to the number of countries in each region is as follows: African region, 6 countries (11.1%); Asia-Pacific, 8 countries (20.2%); West-Asia, 3 countries (27.3 %); Latin America and the Caribbean, 11 countries (33 %); Europe, 41 countries (74.1%); and North America, 2 countries (100 %).

Lead-Acid Batteries

Partnership

- UN Environment partnering with International Lead Association and Pure Earth / Blacksmith Institute

Knowledge

- Needs assessment survey conducted
- Trade and market analysis available
- Commissioned a global profile of lead, source and contamination extent Report.

Implementation

- Technical assistance and capacity- building provided
- Joint BRS-UN Environment project proposal developed
- Proposal on best practices for lead-acid batteries

Infrastructure

- UN Environment joined the Global Battery Alliance
- Promote circular economy and alternatives for lead-acid batteries

Awareness

Work with WHO

- *Recycling of used lead-acid batteries: health considerations.*
- *Side events at notable functions*

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Overall, the work on lead in paint and waste acid batteries is gaining momentum and we look forward to keeping you informed of further progress. Thank you for your attention