

Environmental Impacts of Lead

Toolkit for establishing
laws to eliminate
lead paint

2021 Update

Module B ii.



Global Alliance to
Eliminate Lead Paint

Outline

- **Sources** of Lead Releases
- Environmental **Transport** of Lead
- Impacts on the **Ecosystem**
- Impacts to **Organisms**
- **Bioaccumulation**
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Sources of Lead Releases

Anthropogenic sources



- Mobilization of lead in raw materials such as fossil fuels and other extracted and treated ores and metals
- Releases during the manufacture, use and disposal of products using lead (e.g. paint, batteries, toys)
- Direct releases from waste to soil and aquatic environments



Natural sources

- Volcano
- Weathering of rocks
- Exudates from vegetation
- Windblown dust

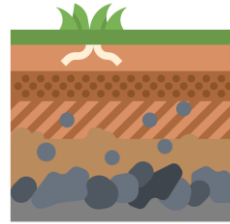
Prior to removal of lead from gasoline, in most countries, leaded gasoline was a significant source of lead

Environmental Transport of Lead



Inorganic lead compound is mainly emitted to the atmosphere as particles. It can be transported by wind and delivered to aquatic and terrestrial environments by wet and dry deposition.

Lead can remain in environment **indefinitely**



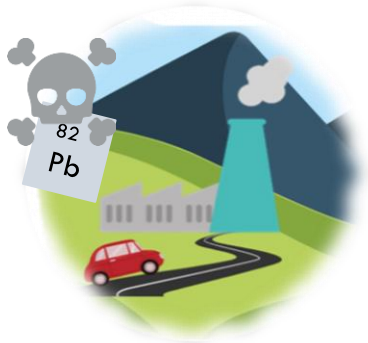
In **soil and sediments** a small portion of lead present is in solution. The majority is strongly **absorbed in matrices as organic matter and iron oxides**. Although lead is not very mobile in soil, lead may enter surface waters as a result of the erosion of lead-containing soil particles and the dumping of waste containing lead products.



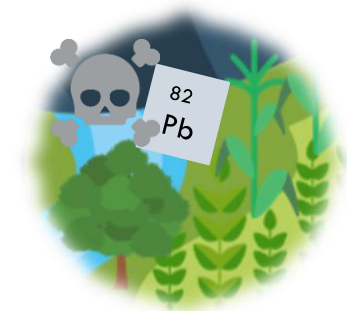
In **aquatic environment** inorganic lead compound may exist in **dissolved ionic form, eventually settling into sediments**. In surface water residence times of biological particles containing lead have been estimated at up to two years. However, The oceanic residence time of lead ranges from about 100 to 1,000 years.

Source: References B ii.2 and B ii.4

Impacts on the Ecosystem



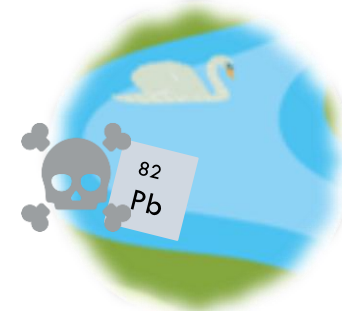
Terrestrial exposure to lead is greatest near point sources (e.g. smelters).



Plants absorb lead from the soil and retain most of the lead in their roots. Translocation of lead from root to plant is limited. Most bound lead stays at roots or leaf surfaces.



Wildlife can be exposed to lead once it is released via contaminated air, water, soil, foodstuffs and human action. In all studied animals, lead has been shown to cause adverse effects in several organs and organ systems (blood, central nervous, kidney, reproductive and immune).



Aquatic exposure to lead is strongly dependent on environmental conditions (pH, salinity, etc.)

Impacts on the Organisms

Lead impacts **micro-organisms**, **higher animals** and **predators**

Birds: Lead poisoning in birds can take the following forms: anemia, lethargy, muscle wasting and loss of fat reserves, green diarrhea staining the vent, wing droop, lack of balance and coordination and other neurological signs such as leg paralysis or convulsions.



Image: http://oxfordleadsymposium.info/wp-content/uploads/OLS_proceedings/download/OLS_proceedings_full.pdf

For instance, lead shot in the waterfowl's gizzards will lead to lead release in blood, kidney, liver, bones. When the waterfowls are eating lead sinker (used for fishing), the lead compounds are digested and dissolved in the acidic environment of the digestive system, leading to the formation of toxic soluble salts, impacting the circulatory system.

The [Agreement on the Conservation of African-Eurasian Migratory Waterbirds](#) (AEWA) and the [Convention on Migratory Species](#) (CMS) - two international environment treaties behind World Migratory Bird Day – are also driving international efforts to tackle the global lead poisoning threat.

Impacts on the Organisms *(continued)*

Plants: High lead concentration (100 to 1,000 mg/kg) in the soil will cause visible toxic effects (impacts on photosynthesis, growth, etc.)

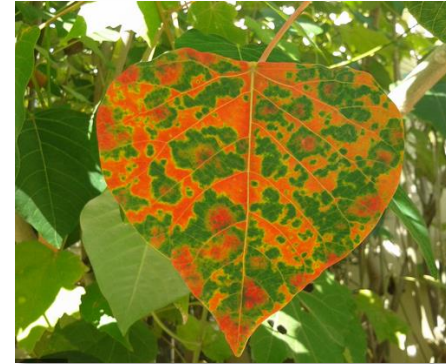


Image:
<https://leadsafeworld.com/nutrition-to-fight-lead-poisoning/>

Image:
http://www.saicm.org/Portals/12/Documents/GEF-Project/Amalyt-WS/Joanna_WHO%20Pb%20paint%20health%20econ%20env_ENG.pdf



Aquatic organisms: Fishes are more affected at early stages of development. Impact on spinal deformity and blackening on the spinal region (black tail).

Micro-organism: Effects from soil with lead concentrations as low as 10 mg/kg. For instance: ingestion of lead-contaminated bacteria and fungi by nematodes can cause impaired reproduction



Image:
<https://www.sokolove.com/blog/lead-contamination-geneva-new-york/>

Source: References B ii.2

Bioaccumulation

Bioaccumulation and biomagnification

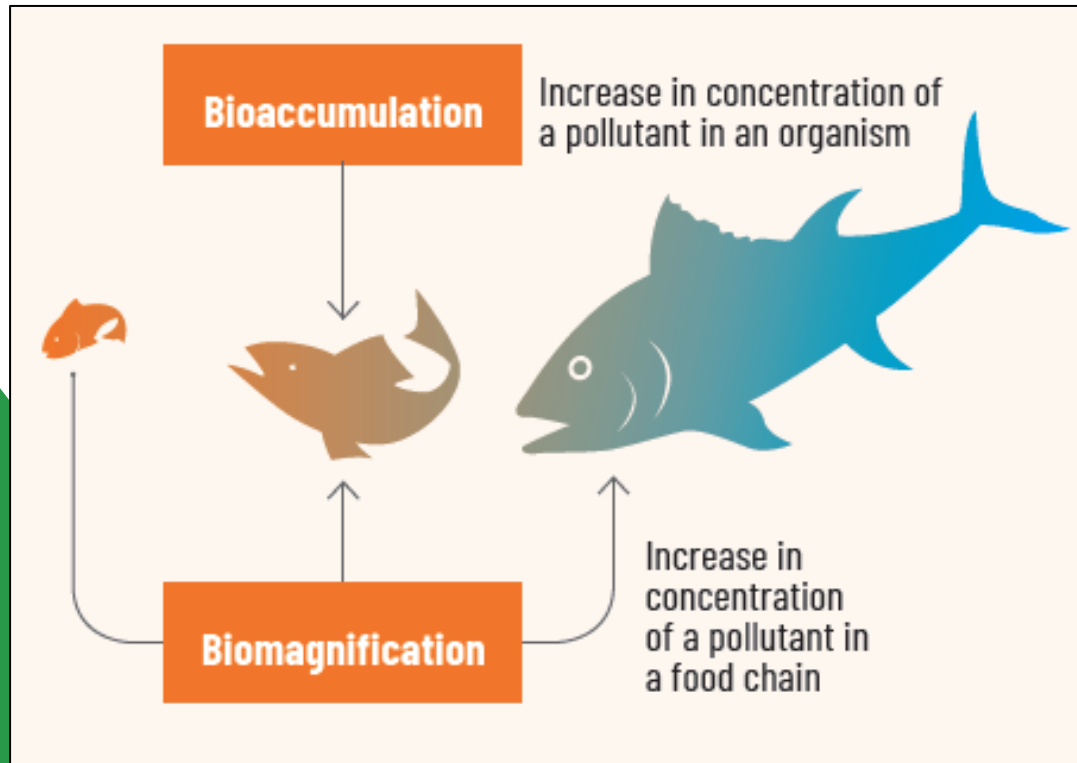


Image <https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/policy-and-governance/global-chemicals-outlook>

Lead is known to **bioaccumulate** in organisms, in particular in biota feeding primarily on particulate matter.

Biomagnification of inorganic lead in the **aquatic food chain** is not apparent, as the levels of lead, as well as the bioaccumulation factors, decrease as the trophic level rises. This is partly explained by the fact that in vertebrates, lead is mainly stored in bone, which reduces the risk of lead transmission to other organisms in the food chain.

Trophic transfer and food chain

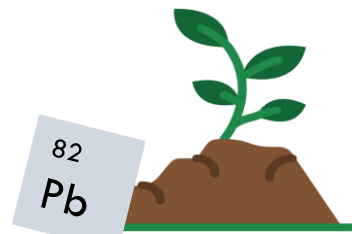
However, **Biomagnification** of inorganic lead has been observed in **terrestrial predators**.

For instance, secondary lead poisoning of bald and golden eagles (eating lead shot contaminated prey) occurs for 10 to 15% of deaths recorded post-fledging mortality.

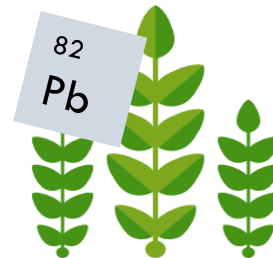


Image: <https://huntfish.mdc.mo.gov/hunting-trapping/hunting-diseases/lead-toxicosis-lead-poisoning>

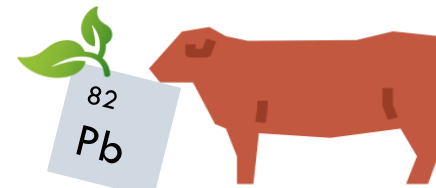
Lead can enter the food chain through the followings:



Crops growing on lead-contaminated land



Direct disposition of lead particles onto crops



Food animals foraging in contaminated area and consuming lead particles



Fish and shellfish living in contaminated water

Summary



Lead is released by various **natural and anthropogenic sources** to the atmosphere and to aquatic and terrestrial environments



The release of lead to lead in the environment is currently **increasing**, diminishing the progress made following the ban on leaded gasoline



Lead can be **easily transported** through the air and water and **impact the ecosystems**



Lead is **toxic**, can have **effects on both terrestrial and aquatic organisms** and can lead to trophic transfer up the food chain

References

- 1. Lead Ammunition: understanding and minimizing the risks to human and environmental health (2014)** Proceedings of the Oxford Lead Symposium Delahay, R.J. & Spray, C.J. (Eds.) - Access [here](#)
- 2. Final review of scientific information on lead (2010)** United Nations Environment Programme - Access [here](#)
- 3. Global Chemicals Outlook, From Legacies to Innovative Solutions (2019)** United Nations Environment Programme - Access [here](#)
- 4. Assessment Report on Issues of Concern: Chemicals and Waste Issues Posing Risks to Human Health and the Environment (2020)** United Nations Environment Programme - Access [here](#)

**Please contact the Chemicals and Health Branch
of the United Nations Environment Programme,
should you have any questions**

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