Lead Poisoning / Plumbism

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Cattle, especially calves, are particularly susceptible to lead poisoning because of their inquisitive nature and tendency to lick or chew foreign objects.



Sources of Exposure



•**Lead-Acid Batteries (Discarded car and tractor batteries):** The most common source on farms and dairies (batteries broken in pastures or scrap metal piles).



•**Flaking Lead Paint:** Ingestion by licking old walls, doors, or barns.

•**Used Engine Oil and Grease:** Cattle are attracted to the sweet taste of hydrocarbons and lead compounds.

•**Slags and Shotgun Pellets:** Especially in waterfowl and raptors, and occasionally ingested by dogs.

•**Lead Pipes, Fittings, and Contaminated Soil:** Around mining sites and lead-smelting industries.

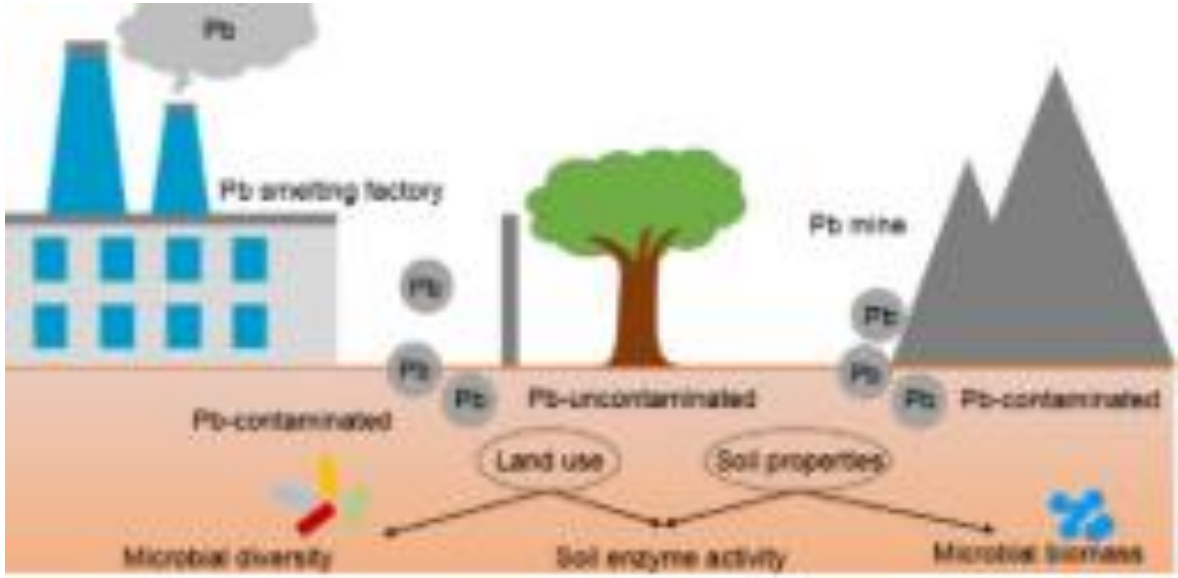

PENNZOIL
PREMIUM
WHEEL BEARING










Pb
Pb smelting factory
Pb mine
Pb
Pb
Pb
Pb
Pb
Pb-contaminated
Pb-uncontaminated
Pb-contaminated
Land use
Soil properties
Microbial diversity
Soil enzyme activity
Microbial biomass

•Following ingestion and absorption into the bloodstream, lead damages 3 primary organs/systems:

•Central Nervous System (CNS) – Acute and lethal effect:

Lead crosses the blood-brain barrier and replaces calcium ions (Ca2+\) in neurons.

It inhibits neurotransmitters and disrupts the sodium-potassium pump → cerebral edema and cerebrocortical necrosis (Polioencephalomalacia - PEM).

•Hematopoietic System – Anemic effect:

Severe inhibition of heme synthesis enzymes (particularly ALAD and ferrochelatase).

Result: Anemia and the formation of red blood cells with basophilic stippling due to ribosomal aggregation (a hallmark hematological sign).

•Bone and Soft Tissues (Chronic accumulation):

The majority of absorbed lead deposits in the hydroxyapatite structure of bones and is re-released during periods of stress, acidosis, or gestation.

In Ruminants (Peracute and neurological form)

- **Apparent Blindness:** The animal collides with walls or obstacles (pupils may be dilated and unresponsive to light).
- **Head Pressing:** A hallmark sign of cerebral edema.
- **Seizures, Muscle Fasciculations, and Bruxism (teeth grinding).**
- **Dysmetria, sudden charging, or maniacal behavior.**
- **Rapid death within 24 to 72 hours following respiratory arrest during convulsive seizures.**

In horses

- Laryngeal hemiplegia (paralysis of the recurrent laryngeal nerve leading to roaring/stridor) difficulty swallowing
- Weight loss
- Weakness in the limbs
- Unlike cattle, horses may show more prominent peripheral nerve paralysis (such as lower motor neuron signs).

In dogs and cats (Gastrointestinal + Neurological):

- Gastrointestinal signs usually precede neurological signs: vomiting, severe abdominal pain (colic), anorexia, and diarrhea or constipation.
- Followed by: seizures, behavioral changes (aggression or unexplained/purposeless howling), and hysteria.

In birds

- **Crop stasis**
- **Wing and leg weakness**
- **Bright green droppings (biliverdinuria).**

Diagnosis & Necropsy

•**History and Source Identification:**

Observing battery fragments or lead plates in the bovine reticulum during necropsy.

•**Brain Histopathology:**

Polioencephalomalacia (laminar cortical necrosis) accompanied by perivascular space dilation due to edema.

•**Complete Blood Count (CBC):**

Presence of normocytic-normochromic anemia along with basophilic stippling (especially in dogs and cattle).

•**Definitive Laboratory Confirmation:**

•Measurement of lead concentration in **whole blood** (not serum, as lead binds to red blood cells). Values above **0.35 ppm** are diagnostic.

•Measurement of lead in liver and kidney tissues in fatal cases (> **10 ppm** on a wet weight basis).

Treatment

•**Lead poisoning treatment relies on specific chelating agents:**

•**Chelating Therapy:**

•**Drug of choice in ruminants:** Calcium disodium EDTA (CaNa2-EDTA) administered via slow intravenous or subcutaneous routes (must be the calcium salt to prevent hypocalcemia).

•**Alternative/supplementary drugs in small animals:** DMSA (Succimer) or D-Penicillamine.

•**Control of Cerebral Edema and Seizures:**

•Mannitol or corticosteroids (such as dexamethasone) to reduce brain tissue swelling.

•Diazepam or barbiturates to control seizures.

•**Physical Removal of the Source from the Gastrointestinal Tract:**

•**Oral Magnesium Sulfate (Epsom salt):** In addition to its laxative effect, it converts free lead in the GI tract into insoluble lead sulfate, which is unabsorbable.

•**Ruminotomy (surgical rumenotomy):** Performed in valuable cattle when battery plates are identified via radiography or examination.