AN OVERVIEW OF RECENT LITERATURE ON THE RISKS TO HUMAN HEALTH AND WILDLIFE FROM OUTDOOR SHOOTING RANGE CONTAMINATION

Lead-contaminated soil can pose a risk through direct ingestion, uptake in vegetable gardens, or tracking into homes. Usually, lead can find its way into your body through breathing it in or ingesting it in the form of food or drink.

Multiple countries are restricting or banning the use of lead ammunition due to the environmental and health consequences, with a focus on banning or restricting use in and around wetlands.[1] The reasoning behind this push to restrict or ban use of lead is that "lead is a toxic metal with known negative impacts on human health, wildlife, and the environment."[2] People and wildlife usually inhale or ingest lead which leads to health issues.

The effects on wildlife include general health issues and a decrease in reproduction[3] – which is an even bigger problem if you have any affected animal populations which are protected or at-risk/endangered. Studies have found high concentrations of lead in the tissues of birds, for example, primarily from ingesting ammunition or anglers' weights.[4] Not only can the lead hurt the birds through direct ingestion, but it can cause changes in their bodies and their behaviors which make them more susceptible to other predators, or starvation and infectious diseases.[5]

The authors of studies like the ones quoted above suggest that the most practical way to remove the risk of lead poisoning from lead ammunition is to use non-toxic alternatives, otherwise large numbers of birds will continue to die unnecessarily from lead poisoning.[6] Such non-toxic alternatives are already existing and widely available and effective.[7]

Other studies note that soil pollution at firing ranges is "an issue of growing importance, due to the accumulation in soils of contaminants derived from ammunition and clay targets."[8]

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[1] Europe is on its way to substantially restricting all lead ammunition use within 5-10 years. Denmark and The Netherlands have total bans on lead shotgun ammunition. 16 more countries have specific bans on using lead shotgun ammunition over wetlands, or hunting water birds. Since 2/15/2023, use and possession of lead shotgun ammunition was prohibited over and within 100 m of all wetlands in the European Union. https://wildlife.onlinelibrary.wiley.com/doi/10.1002/wsb.1449 , **Efforts to ban lead ammunition: a comparison between Europe and the United States, by** Matthew B. Ellis, Craig A. Miller, published 6/4/2023.

[2] *Id.*

[3] "Lead has long been recognized as a poison to living organisms, with negative effects on general health, reproduction, behavior, and potentially leading to death. Ingestion and inhalation are the two most common entry routes of lead into animals (Demayo et al., 1982; Eisler, 1988; Pain, 1995; Mateo, 1998b; Guitart et al., 1999)." Biological Conservation 131 (2006) 421-432, **A review of lead poisoning from ammunition sources in terrestrial birds,** by Ian J. Fishera,*, Deborah J. Paina, Vernon G. Thomas, Royal Society for the Protection of Birds.

[4] *Id.*

[5] *Id.*

[6] *Id.*

[7] *Id.*

[8] Abstract from: Science of the Total Environment, Volume 575, 1 January 2017, pages 367-377; **Lead and PAHs contamination of an old shooting range: A case study with a holistic approach**, by A. Rodriguez-Seijo, A. Cachada, A. Gavina, A.C. Duarte, F.A. Vega, M.L. Andrade, and R. Pereira.

Lead ammunition is mainly composed of, well, lead (between 90-99% Pb).[9] Skeet shooting usually involves lead ammunition loaded with Pb pellets which are 95-100% lead.[10]

Clay targets are also an environmental risk. They spread into fragments of different sizes, and the binder (coal tar pitch or petroleum) is full of carcinogens such as PAHs.[11] Once on the soil, the lead and other metals are oxidized and become more mobile, and more easily absorbed by roots or other organic matter, which makes the metals more likely to enter the food web.[12]

When the soil has a high level of contamination of lead or PAHs, the soil is compromised for other uses.[13] The study done in Spain which I read showed shooting range soils to have high concentrations of Pb and PAHs, which made those soils inappropriate for other uses, if no remediation measures were going to be applied.[14]

Just like lead ammunition, countries are working to restrict the PAHs in clay targets used for shooting practice. The European Chemical Agency's Committee for Risk Assessment is supporting a proposal to restrict PAHs in clay targets for shooting to prevent emission of the toxic substances that build up in humans and animals (many PAHs are known to cause cancer).[15] The PAH-containing clay targets are shattered by gunshot into the open environment, with little possibility of applying risk management measures.[16] In addition to lowering the risk to wildlife and plants, this restriction on PAH-containing clay targets "will reduce exposure and related cancer risk for workers and the public handling and shooting clay targets."[17]

The expert who tested the soil at Primrose Gun Club noted that the PAH soil test results reflect a study of the sporting clay fall area. He said that coal tar in the clay targets is the source of the PAH compounds. He noted that five of the PAHs (Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Dibenz[a,h]anthracene, Indeno[1,2,3-c,d]pyrene) exceeded the WDNR direct contact residual contaminant limits (RCL) for soil. He also gave you the comparison levels of background PAHs for the urban core of Milwaukee – which scientists studying pollution will sometimes do, as urban areas where manufacturing and construction have been prominent will often have higher numbers than we want. He told you in the report "As more sporting clays are dispersed on the ground in this area the contaminant concentration levels will continue to increase." He also noted that the compounds he found are "known to be particularly persistent in soil with residence times of multiple decades." He also mentioned that surface water supplies may be impacted if soil washes from the field into a nearby stream during a large rain. He noted finally that "As with the soil lead found at the club, the primary health risk to human from these PAHs would be if the land use changes and the area is converted to playgrounds, gardens or another activity where high human-soil contact takes place."

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[9] *Id.*
[10] *Id.*
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] *Id.*
[15] https://echa.europa.eu/-/cancer-causing-pahs-in-clay-targets-need-an-eu-wide-ban , **Cancer-causing PAHs in clay targets need an EU-wide ban,** ECHA/NR/22/15 (European Chemicals Agency).
[16] *Id.*
[17] *Id.*

It is of special concern that the scientist who wrote the report about the soil samples mentions playgrounds, gardens, or activities involving high human-soil contact. This is because lead is especially dangerous for children. In fact, where lead contamination is an issue, they often advise against allowing children in that area, or even pregnant women or women who may become pregnant in the future. So whatever uses the club would have for their space, clean up may need to be a priority to protect children and women of child bearing age if they are in those shooting range spaces.[18] The CDC says there is NO SAFE LEVEL OF LEAD in the blood of a child.[19] Preventing exposure to lead is so important that Wisconsin statutes define at least fourteen terms which mention lead (see WI Statute 254.11, under "Toxic Substances")

Based on the results Siemering found, it seems that the Benzo [a] pyrene levels are 24 times higher than RCLs, the Benzo [a] flourathene levels are 3 times higher, the Dibenz [ah] anthracene levels are also 3 times higher, and the Benz[a]anthracene is at almost 2 times the legal limit.

In his report, Siemering also mentions that composite sampling and averaging helps to "smooth out the variation and given more useful scientific data" I would say that is not particularly helpful in terms of safety. For example, if you or your kid, or your pregnant wife, or an employee, is spending time at the area sampled showing 307 ppm, that seems dangerous. Siemering also warns that if the property is sold, future potential buyers should be warned of the lead contamination of the soil. He further advises that human contact with the soil should be avoided or limited.

As a final note, the U.S. Navy conducted an eight and a half year long study on PAHs in government skeet range clay targets which was recently published.[20] The Navy noted that the source of PAHs from skeet show up as coal tar pitch or bitumen, used as binders in the targets.[21] The Navy also states that multiple PAHs are regulated currently by the EPA as carcinogens.[22] There was also a mention in this report of how other contaminants (besides the PAHs) cause a property used as a shooting range to be unused after being decommissioned. The contaminant they mention? Lead from gun pellets, which the Navy referred to "hazardous material."[23]

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[18] For more information on the hazards to pregnant women and children in particular, see https://www.health.ny.gov/publications/2526.pdf , "What Your Child's Blood Lead Test Means" (they tell us Lead can harm a child's growth, behavior, and ability to learn. The lower the (blood lead levels) test result, the better. Lead poisoning can occur when kids lick, swallow or breathe lead dust.)

[19] https://www.cdc.gov/phlp/docs/laws-bll.pdf

[20] Naval Information Warfare Center, Pacific (the US Navy)'s Technical Report 3236, August 2021,"Toxicity Associated with PAHs in Navy Skeet Range Clay Targets" https://apps.dtic.mil/sti/trecms/pdf/AD1145925.pdf

[21] *Id.*

[22] *Id.*

[23] *Id.*