

Xenobiotic Contaminants Emitted from Landfill Fires and Associated Public Health Impacts: A Systematic Review

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INTRODUCTION & AIM

- Global solid waste generation continues to increase, particularly in low- and middle-income countries where waste management infrastructure is often inadequate (Alimba and Adesida, 2026).
- Consequently, open burning of wastes at uncontrolled landfill sites is frequently used to reduce waste volume; a practice that generates large quantities of hazardous xenobiotic contaminants, including polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), heavy metals, particulate matter (PM_{2.5}/PM₁₀), volatile organic compounds (VOCs), and other toxic combustion products (Alimba et al., 2016).
- These pollutants are environmentally persistent, capable of long-range transport, bioaccumulate in food chains, and pose significant risks to ecosystem and human health.
- This review systematically synthesizes current evidence on xenobiotic contaminants emitted from landfill fires and evaluates the ecological and public health consequences associated with these emissions.

METHODOLOGY

A systematic review was conducted following the PRISMA framework using a structured literature search from major scientific databases.

Eligibility Criteria

Included studies: Peer-reviewed studies reporting quantitative measurements of xenobiotic contaminants emitted from landfill fires, along with their toxicological outcomes in biota and environmental matrices.

Data Extraction

- Contaminant type and concentration
- Environmental compartment affected
- Exposure pathways
- Toxicological endpoints
- Reported ecological and human health impacts

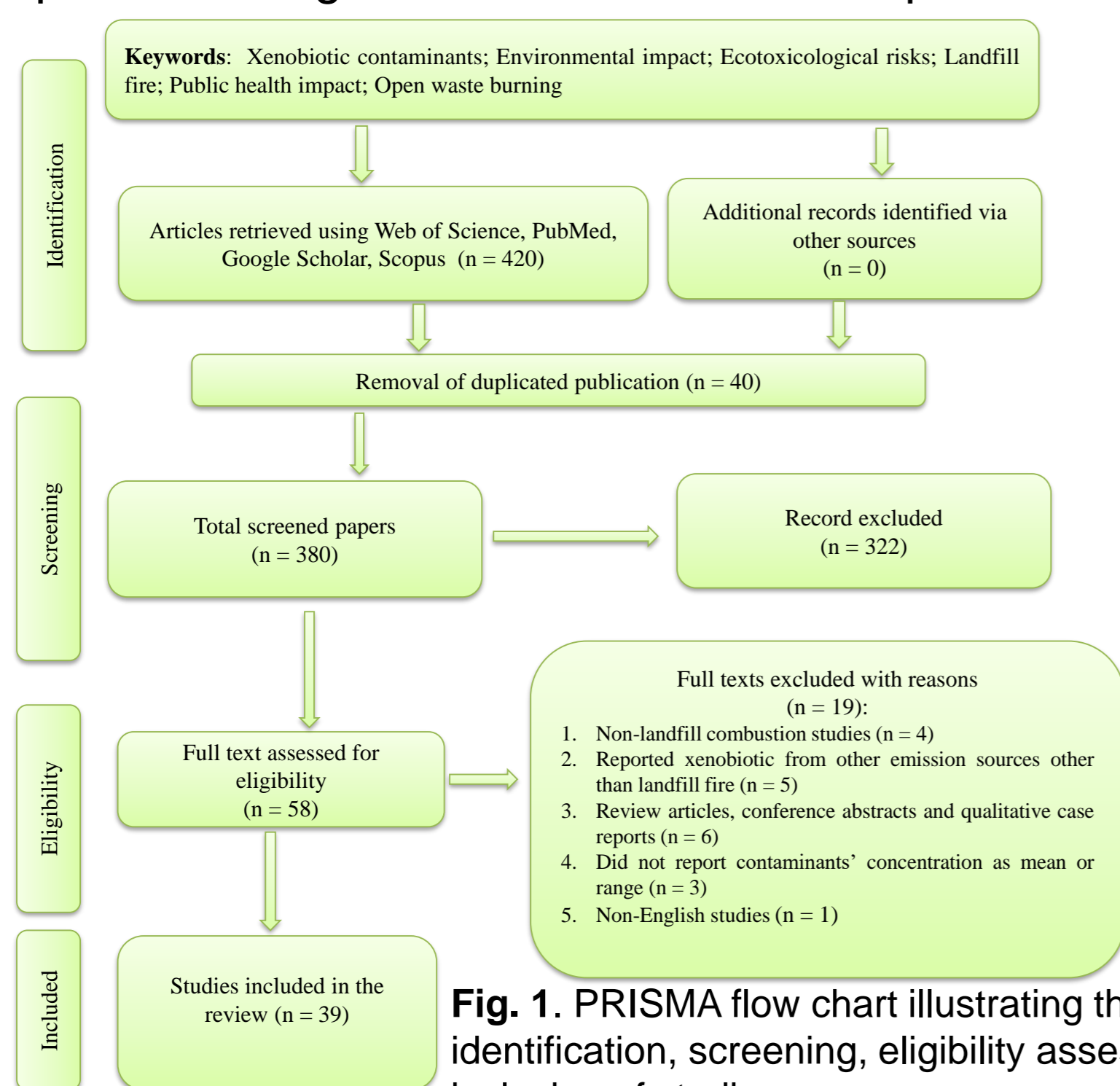


Fig. 1. PRISMA flow chart illustrating the process of literature identification, screening, eligibility assessment, and final inclusion of studies

RESULTS & DISCUSSION

Table 1. Major xenobiotic contaminants identified and their potential sources

Contaminant Group	Major Sources During Landfill Fires	Health Concern
PAHs	Incomplete combustion of plastics, tyres, biomass	Mutagenicity, carcinogenicity
Dioxins/Furans (PCDD/Fs)	Burning chlorinated wastes	Endocrine disruption, cancer
Heavy Metals (Pb, Cd, Hg, Cr, Ni)	E-waste, batteries, industrial wastes	Neurotoxicity, organ damage
Particulate Matter (PM _{2.5} , PM ₁₀)	Combustion smoke	Respiratory and cardiovascular disease
VOCs	Mixed waste combustion	Neurological and respiratory effects

Studies consistently reported elevated concentrations of PAHs, dioxins, heavy metals and other contaminants in air, ash, soils and nearby aquatic environments following landfill fire events.

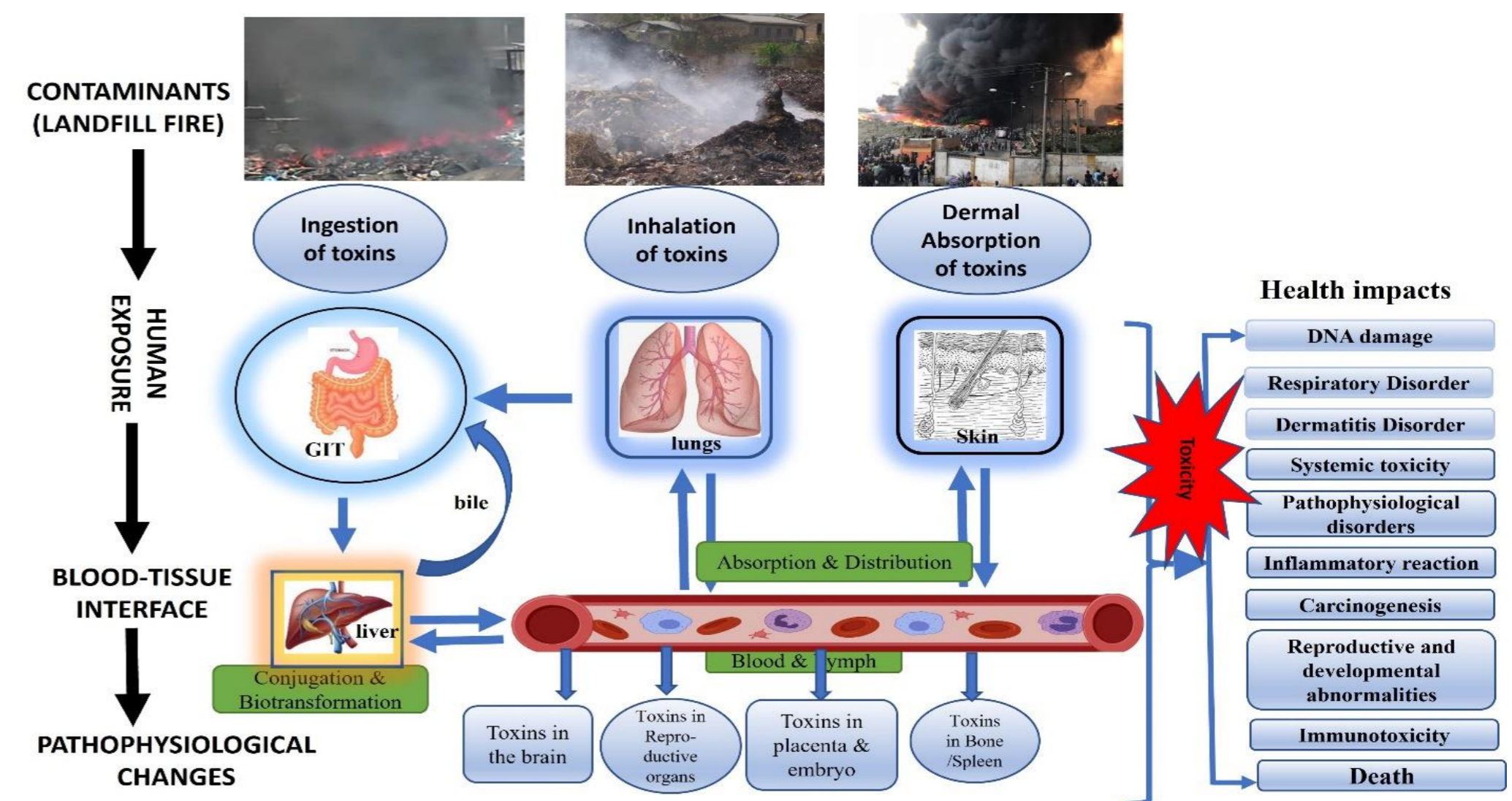


Fig. 2. Conceptual framework illustrating xenobiotic emissions from landfill fires, human and environmental exposure routes, and associated adverse health outcomes (Alimba and Adesida, 2026).

CONCLUSION

Landfill fires represent a significant yet underregulated source of xenobiotic contaminants. This systematic review demonstrates that emissions of inorganic and organic pollutants contribute substantially to environmental contamination and human health risks. Evidence indicates multiple exposure pathways leading to respiratory, cardiovascular, reproductive, developmental, and carcinogenic outcomes. Strengthening waste management systems and preventing landfill fires are critical interventions for protecting public health and environmental quality.

FUTURE WORK / REFERENCES

- ✓ Transition from open dumping to engineered sanitary landfills
- ✓ Ban deliberate waste burning practices
- ✓ Implement continuous environmental monitoring around landfill sites
- ✓ Strengthen landfill fire surveillance and emergency response systems
- ✓ Promote waste segregation, recycling, and public awareness programmes

Alimba et al. (2016). Chemosphere, 164, 469-479

Alimba and Adesida, (2026). World Scientific Series on Advances in Environmental Pollution Management, Soil Contamination. pp. 137-155.