



Addressing metal exposure and toxicity

Caroline Kim

School of Medicine
University of California, Riverside

Abstract

Humans are exposed to heavy metals through a variety of ways such as inhalation of contaminated air, intake of polluted water and food, skin contact, and occupational exposure. At sufficient levels, heavy metals can elicit detrimental health effects, generally interfering with cellular function, damaging metabolic processes, initiating carcinogenesis, and promoting overall organ system dysfunction.

To protect patients from heavy metal exposure near the Salton Sea, doctors and health workers can treat symptoms early by testing for metals in blood, promoting diets that limit metal absorption, and giving clean water. Communities can also prevent harm by using face masks like N95s, staying indoors when dust levels are high, planting vegetation, and supporting local dust control projects that stop toxic dust from spreading.

Introduction

Formed accidentally from Colorado River flooding in 1905, the Salton Sea is a lake in Southern California that has no outlet and fills from farm water runoff. In recent decades, it has shrunk, and the resulting dry lakebed (called playa) now sends dust into the air. This dust contains farm chemicals and heavy metals, which are naturally

occurring elements of the Earth's crust that have a greater density than water (Ferguson, 1990). The heavy metals can accumulate in the environment and lead to toxicity at low exposure levels, harming local human health (Biddle et al., 2021; Lo et al., 2022; UCR 2023).

Health effects on kids and families

Human exposure to heavy metals occurs in various ways: inhalation of air/dust particles, drinking contaminated water, through the food chain, and so on. Their accumulation in our bodies can lead to all sorts of different toxic effects, varying by the type of metal, dose, route, and duration of exposure.

Airborne dust contains tiny particles, or particulate matter (PM), with heavy metals like arsenic, cadmium, and lead. Dust storms spread PM, resulting in coughing, asthma attacks, and limited outdoor activity. When ingested or inhaled, these heavy metals can also cause neurological damage and increase the risk of cancer. Moreover,

studies show that metal exposure is associated with higher rates of respiratory problems and developmental delays in children living near the Salton Sea compared to children living in other parts of California (UCR 2023; Lo, Biddle, et al., 2023).

Aluminum is also present in the air as particles coming from rocks and soil. The main routes of intoxication are: inhalation, skin exposure,

and through the mouth. Aluminum can accumulate in the human body, and aluminum toxicity can then manifest as a wide range of pathological conditions, which we call aluminum toxicosis. Aluminum compounds may negatively impact the brain, promote inflammation, cause lung and heart problems, and increase risk of gastrointestinal cancer (Jomova et al., 2023).

Prevention

These health issues persist, greatly due to the increasing use of heavy metals in today's industrial activities. To mitigate the potential ramifications of heavy metal pollution, robust technologies are being developed to extract heavy metals from contaminated environments. To advance these efforts, local communities can consider taking the following actions: (1) to lower heavy metal-related health risks, healthcare

providers recommend regular screening for heavy metals, especially for high-risk individuals; (2) preventative measures like wearing masks, staying indoors during dust storms, and using air purifiers and water filters can help limit exposure to heavy metals; and (3) community groups are also advocating for dust management practices, such as restoring wetlands and planting grass or native plants to grip the ground.

References

- Abd Elnabi, M. K., Elkaliny, N. E., Elyazied, M. M., Azab, S. H., Elkhalfifa, S. A., Elmasry, S., Mouhamed, M. S., Shalamesh, E. M., Alhoriény, N. A., Abd Elaty, A. E., Elgendy, I. M., Etman, A. E., Saad, K. E., Tsigkou, K., Ali, S. S., Kornaros, M., & Mahmoud, Y. A.-G. . (2023). Toxicity of Heavy Metals and Recent Advances in Their Removal: A Review. *Toxics*, 11(7), 580. <https://doi.org/10.3390/toxics11070580>
- Biddle, T. A., Li, Q., Maltz, M. R., Tandel, P. N., Chakraborty, R., Yisrael, K., Drover, R., Cocker, D. R., & Lo, D. D. (2021). Salton Sea aerosol exposure in mice induces a pulmonary response distinct from allergic inflammation. *Science of the Total Environment*, 792, 148450. <https://doi.org/10.1016/j.scitotenv.2021.148450>
- Biddle, T. A., Yisrael, K., Drover, R., Li, Q., Maltz, M. R., Topacio, T. M., Yu, J., Del Castillo, D., Gonzales, D., Freund, H. L., Swenson, M. P., Shapiro, M. L., Botthoff, J. K., Aronson, E., Cocker, D. R., & Lo, D. D. (2023). Aerosolized aqueous dust extracts collected near a drying lake trigger acute neutrophilic pulmonary inflammation reminiscent of microbial innate immune ligands. *Science of the Total Environment*, 858, 159882. <https://doi.org/10.1016/j.scitotenv.2022.159882>
- Fergusson, J.E. (1990) *The Heavy Elements Chemistry, Environmental Impact and Health Effects*. Pergamon Press, Oxford, 85-547. <https://www.scirp.org/reference/referencespapers?referenceid=1290438>
5. Jomova, K., Alomar, S. Y., Nepovimova, E., Kuca, K., & Valko, M. (2024). Heavy metals: toxicity and human health effects.

Archives of Toxicology, 99. <https://doi.org/10.1007/s00204-024-03903-2>

Lo, D., Biddle, T.A., Meyer, A.G., & Rich, M.M. (2022, December 8). Salton Sea dust triggers inflammation. *UC Riverside News*. Retrieved from news.ucr.edu 7. University of California, Riverside (UCR). (2023, June 1). Salton Sea environment detrimental to respiratory health of local children. *UCR News*. Retrieved from <https://news.ucr.edu/articles/2023/06/01/salton-sea-environment-detrimental-respiratory-health-local-children>



Disclaimer: This content is for informational purposes only and is not a substitute for professional medical advice, diagnosis, or treatment. Always consult your healthcare provider with any questions.