

# Environmental Leaching Assessment of EAF and Caster Slag – Stabilized Soils for Sustainable Applications

Sindhu Uthaiah, Jongwan Eun, PhD, PE, Department of Civil & Environmental Engineering at University of Maryland

## Introduction

- The steelmaking industry generates approximately 12–17% of EAF slag per ton of steel. In recent times, most developed countries re-use slags in low-value applications, the most common being construction aggregates. However, this practice may also pose environmental repercussions. Leaching into the groundwater is observed in different pH conditions in various papers.

## Objective

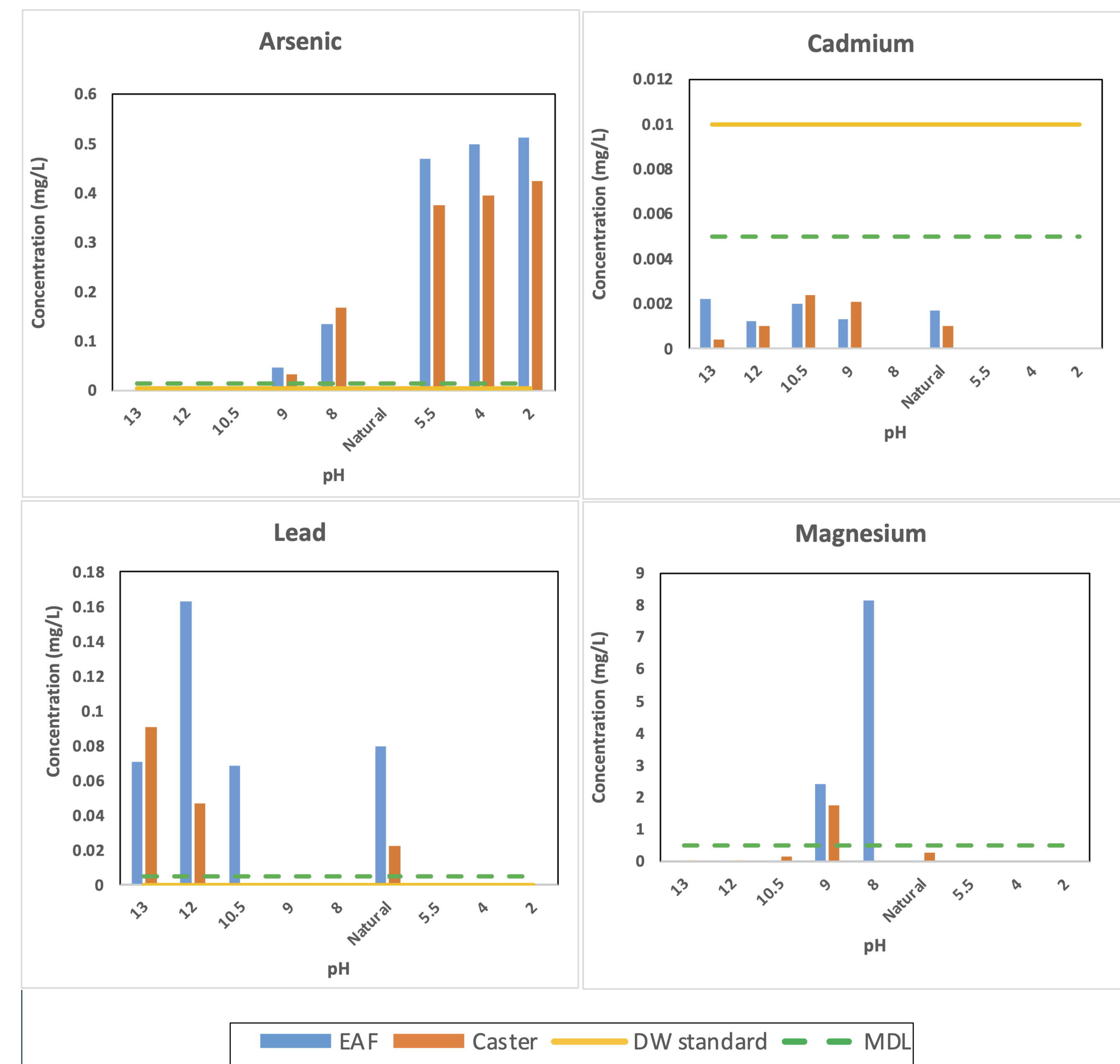
- This study examines the environmental leaching of heavy metals from EAF and Caster slag. The slag samples are assessed in stabilized soils and compared against drinking water standards to evaluate environmental safety. The objective is to address the challenge of unsustainable disposal practices and analyze the suitability of slag-stabilized soils as aggregates for sustainable applications in road and pavement construction.

## Methods

- EPA 1311(TCLP) to mimic leaching of contaminants from waste materials in the land fill environment and EPA1313 (Liquid-Solid Partitioning (LSP) as a Function of pH determines how much of a solid material's constituents will leach into water at different pH levels.
- Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) was used to analyse the filtrates. The technique quantified heavy metal concentrations to evaluate leaching potential under different pH conditions. The analysis focused on As, Cr, Pd, Mg, Mn and Cd.

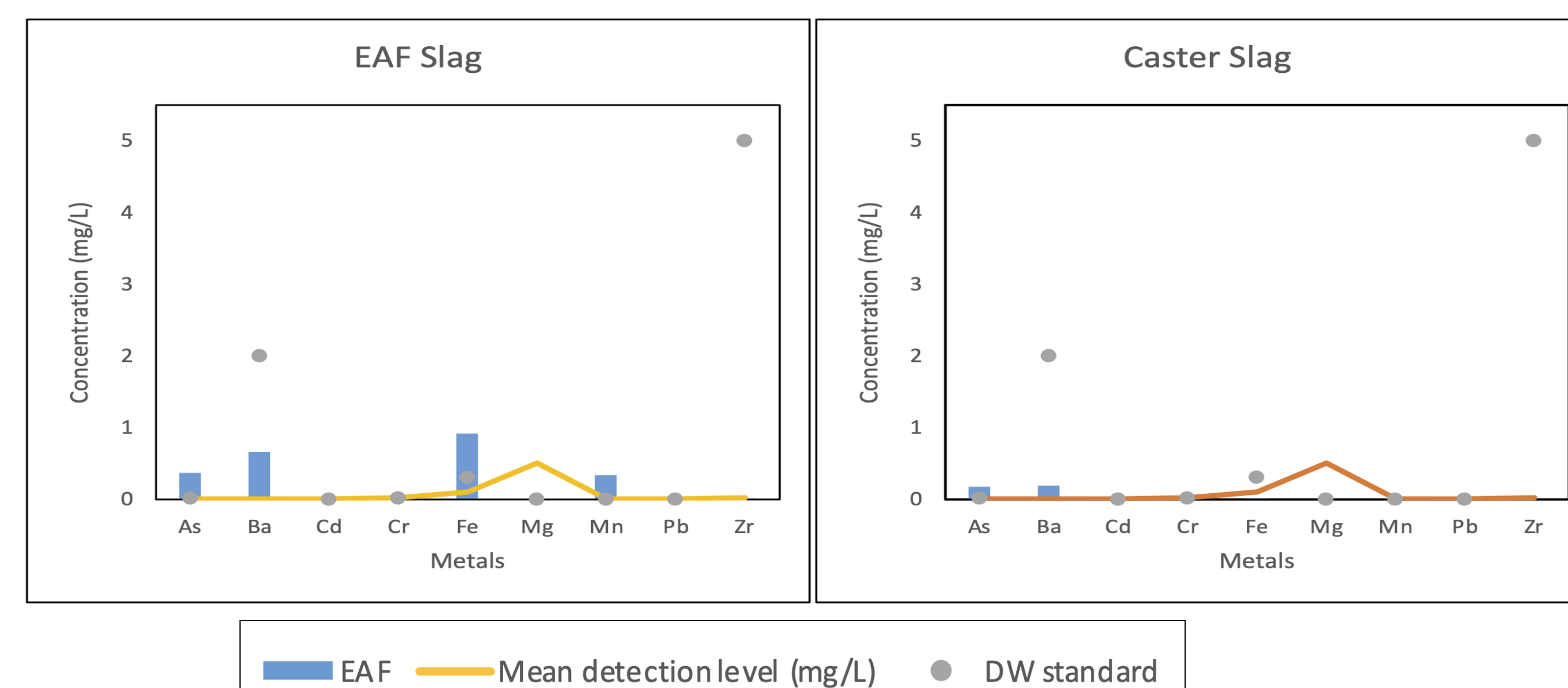
## Results

### ❖ EPA 1313 evaluation of leaching behavior



- Arsenic mobilized under acidic and moderately alkaline conditions; lead leached under both highly alkaline and near-neutral states, showing amphoteric behaviour.
- Cadmium remained negligible, with only slight release in alkaline conditions. Magnesium increased under moderately alkaline states but stayed controlled elsewhere, higher in EAF than caster.

### ❖ EPA 1311 assessment of leaching behavior



- EPA 1311(TCLP) to mimic leaching of contaminants from waste materials in the land fill environment and EPA1313 (Liquid-Solid Partitioning (LSP) as a Function of pH determines how much of a solid material's constituents will leach into water at different pH levels.

## Conclusion

- EAF and caster slags showed low leaching for most metals, but arsenic consistently exceeded drinking water standards and lead leached under certain alkaline and near-neutral conditions. Cadmium and magnesium remained negligible or below detection. While slags may be considered for pavement use, arsenic and lead release pose potential groundwater risks without stabilization.

## Future Work

- Column leaching tests will mimic real-world field conditions with carbonation, alongside life cycle analysis to evaluate long-term impacts.

## Reference

- Tossavainen et al. *Sci. Total Environ.* (2009).[\[1\]](#)  
 Li et al. *Sci. Total Environ.* (2009). [\[2\]](#)  
 Tiwari et al. *J. Radiat. Res. Appl. Sci.* (2015). [\[3\]](#)  
 Mombelli et al. *J. Environ. Chem. Eng.* (2016). [\[4\]](#)  
 Engström et al. *Steel Res. Int.* (2014). [\[5\]](#)  
 Kurecki et al. *Metals* (2021)[\[6\]](#)  
 Wang et al. *Crystals* (2021). [\[7\]](#)  
 Grathwohl & Susset. *Waste Manage.* (2009). [\[8\]](#)  
 Li et al. *Sustainability* (2021). [\[9\]](#)  
 Kim et al. (2020), *Minerals*, 10(10), 900.[\[10\]](#)

## Acknowledgement

Grateful to the Nebraska Department of Transportation for supporting this study.