

Zurich, Switzerland Start date: January 2019

A PARAMETERIZED MODEL FOR ASSESSING ENVIRONMENTAL IMPACTS FROM TAILINGS: A LIFE CYCLE ASSESSMENT APPROACH

Reclaim

Evaporation

Tailings

Emissions

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Run-off

Liner

BACKGROUND

Problem: Various tailings site have specific emissions

- Interactions with environment may cause acid mine drainage
- The needs to create an environmental impacts predictor for tailings storage facilities, considering short- and long-term perspectives

Approach: Environmental assessment with site-specific factors

- Life cycle assessment (LCA) implementation in mining is limited
- Tailings life cycle inventory are somewhat generic in LCA databases

OBJECTIVES AND MILESTONES

Building parameterized LCA of tailings storage facilities

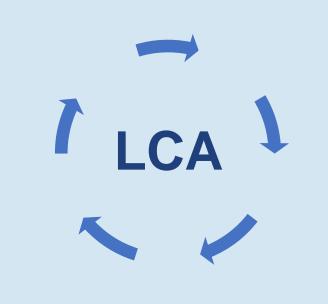
Q2 2021

- Process flowsheets

Part 2

Assessing environmental impacts of conventional tailings

Combining robust models (geochemical, hydrology) with LCA



management

Q3 2020

Part 1

(This poster)

- Working models

Active copper

mining database

Holistic

Standardized

Transparency

"The compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its <u>life cycle</u>" ISO 14040/44

Q1 2022

Part 3

(Scenario analysis)

- PhD research plan

Figure 1. Schematic of conventional tailings disposal system

Boundary

Soil

Groundwater

Precipitation

Tailings

discharge

Seepage

collection

PRELIMINARY RESULTS

Minerals buffering

Calcite, siderite, and other buffers control the mine drainage phenomenon

Washing out of minerals

The amount of leached heavy metals depends on initial condition and annual net infiltration rate

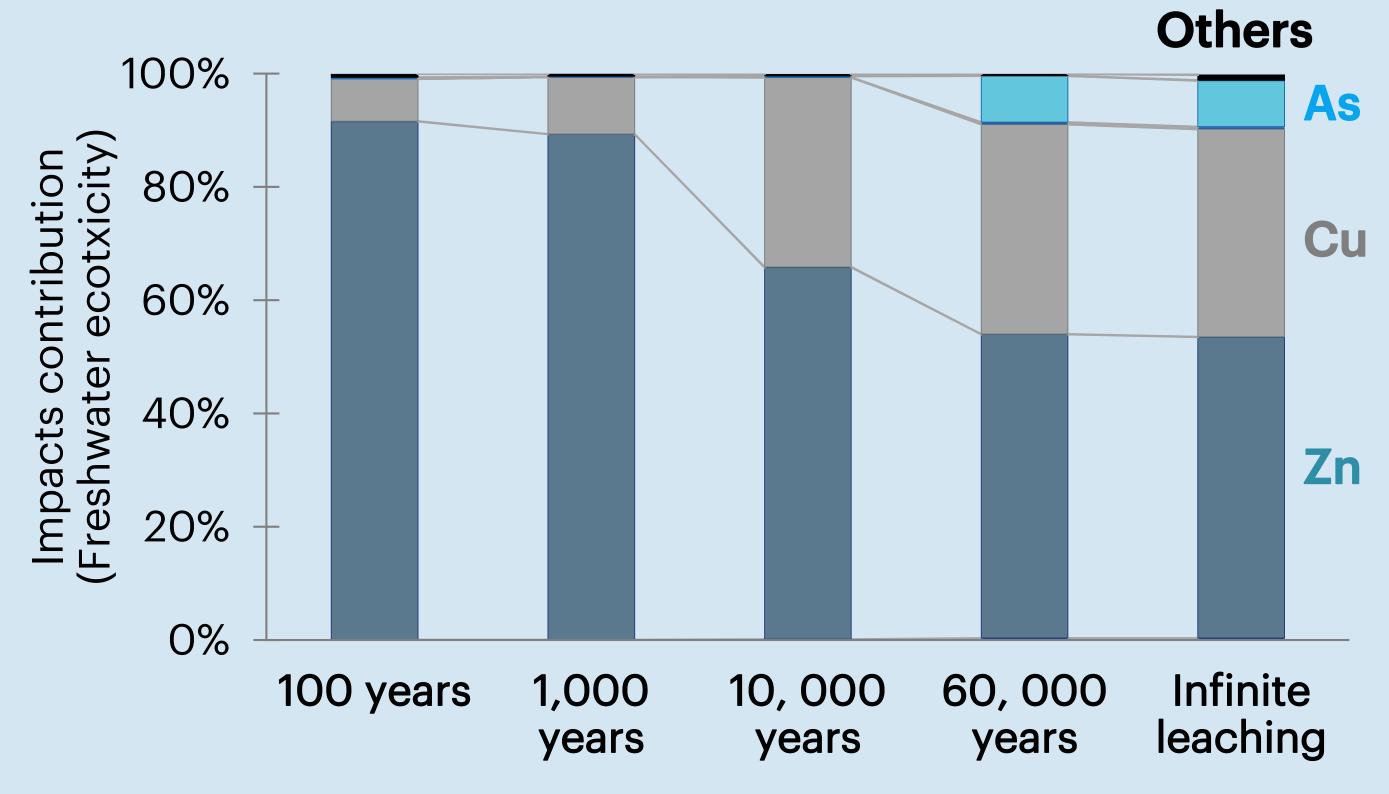
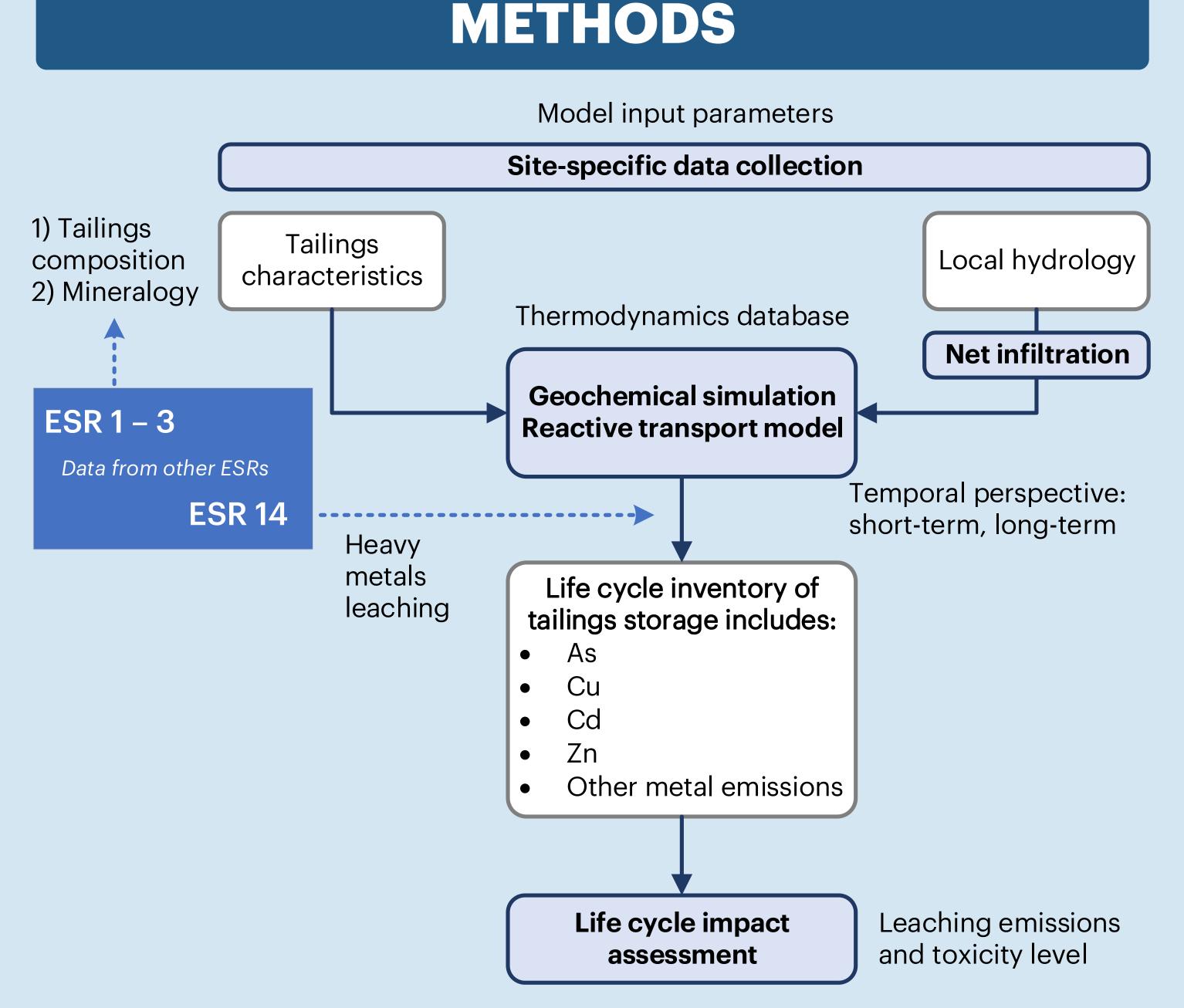


Figure 2. Contribution analysis of tailings storage environmental impacts at different time frames (Method: USEtox®)

METHODE

- LCA seminar and workshop with ESRs

(LCA of emerging processes)



Data (sources):

- Site conditions
- Tailings mineralogy (ESRs)
- Leaching tests (ESR 14)
- Hydrology

Models incorporated:

- Geo chemical reactive transport
- Water balance
- Life cycle assessment
- Beneficiation (model extension)

CONCLUSION

- Integration of site-specific factors (geochemistry, rainwater infiltration) improves life cycle inventory modelling of tailings site
- Leaching of heavy metals depend highly on the mineralogy characteristics (buffering)
- Time horizon affects substantially how metals toxicity are quantified in life cycle impact assessment

NEXT STEPS

Beneficiation model construction

Industry data, technical reports

Sulfidic tailings database
Global assessment, market intelligence

Data collection for LCA WP 2 and WP 3

Prospective assessment for emerging technologies

Part 2 of PhD work



