Objective: Direct extract and purify rare earth elements (REEs) from mine drainage to concentrations > 90%.

- Case A: REE extraction from low pH mine water
  - pH adjustment between 2.5 and 4.5
  - Major ions include Fe, Al, Mn, SO4, Ca, Mg
  - ~50% of Fe is Fe^{3+}
  - High purity co-precipitation on FeOOH surfaces

- Case B: REE extraction from net alkaline mine water
  - Co-precipitation of lanthanides with FeOOH.
  - Preliminary results are promising.
  - Initial solutions contain 300 ppm Fe(II) + ~1 ppm La or Y.
  - Control redox, pH
  - >98% of La and Y co-precipitate with FeOOH.
  - Separation and dissolution of FeOOH yields >10-fold increase in lanthanide concentration.

Project Deliverables:
- Systems evaluation
  - Model: gangue and REE separation
  - Batch tests: laboratory validation testing
  - Pilot tests: ALSX bench-scale testing
  - Techno-Economic Analysis (TEA)