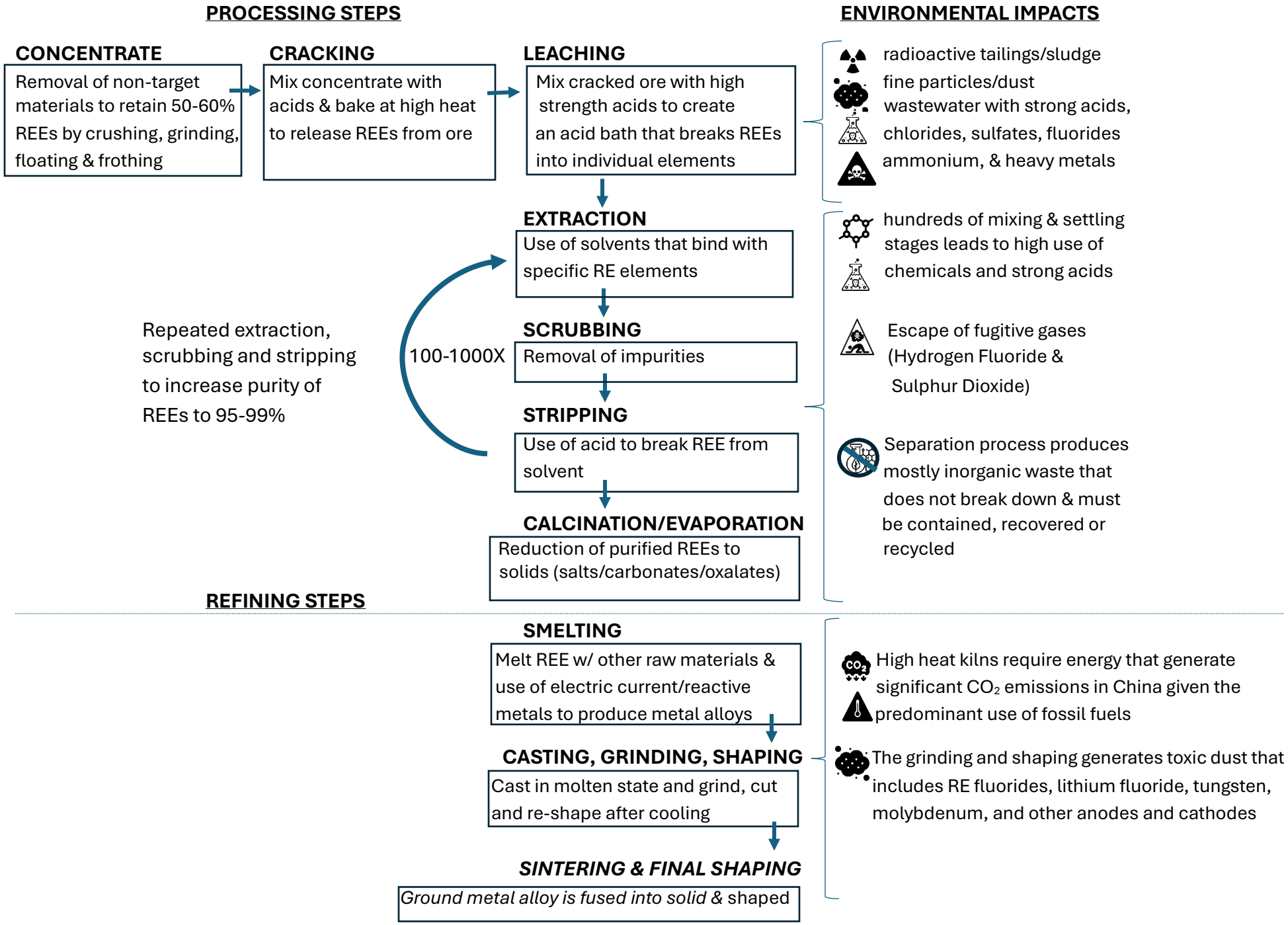
PROCESSING STEPS
ENVIRONMENTAL IMPACTS
CONCENTRATE
Removal of non-target materials to retain 50-60% REEs by crushing, grinding, floating & frothing
CRACKING
Mix concentrate with acids & bake at high heat to release REEs from ore
LEACHING
Mix cracked ore with high strength acids to create an acid bath that breaks REEs into individual elements
radioactive tailings/sludge
fine particles/dust
wastewater with strong acids, chlorides, sulfates, fluorides ammonium, & heavy metals
EXTRACTION
Use of solvents that bind with specific RE elements
hundreds of mixing & settling stages leads to high use of chemicals and strong acids
Repeated extraction, scrubbing and stripping to increase purity of REEs to 95-99%
100-1000X
SCRUBBING
Removal of impurities
Escape of fugitive gases (Hydrogen Fluoride & Sulphur Dioxide)
STRIPPING
Use of acid to break REE from solvent
Separation process produces mostly inorganic waste that does not break down & must be contained, recovered or recycled
CALCINATION/EVAPORATION
Reduction of purified REEs to solids (salts/carbonates/oxalates)
REFINING STEPS
SMELTING
Melt REE w/ other raw materials & use of electric current/reactive metals to produce metal alloys
High heat kilns require energy that generate significant CO_2 emissions in China given the predominant use of fossil fuels
CASTING, GRINDING, SHAPING
Cast in molten state and grind, cut and re-shape after cooling
The grinding and shaping generates toxic dust that includes RE fluorides, lithium fluoride, tungsten, molybdenum, and other anodes and cathodes
SINTERING & FINAL SHAPING
Ground metal alloy is fused into solid & shaped