

15 November 2023

Battery metals from mine waste:

# Australia's green opportunity

Dr. Helen Degeling

ASX: COB



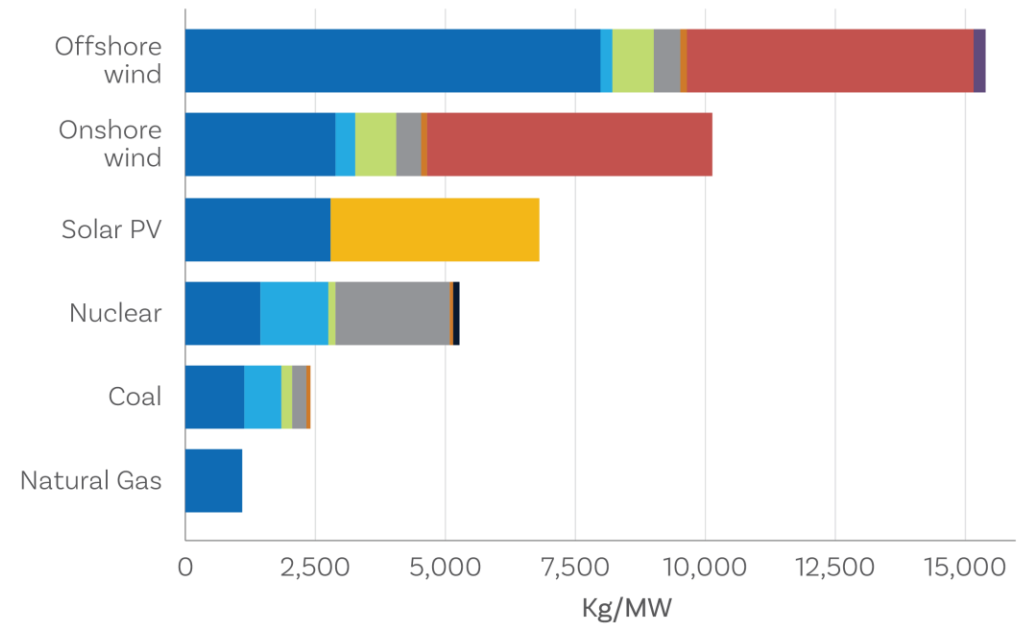
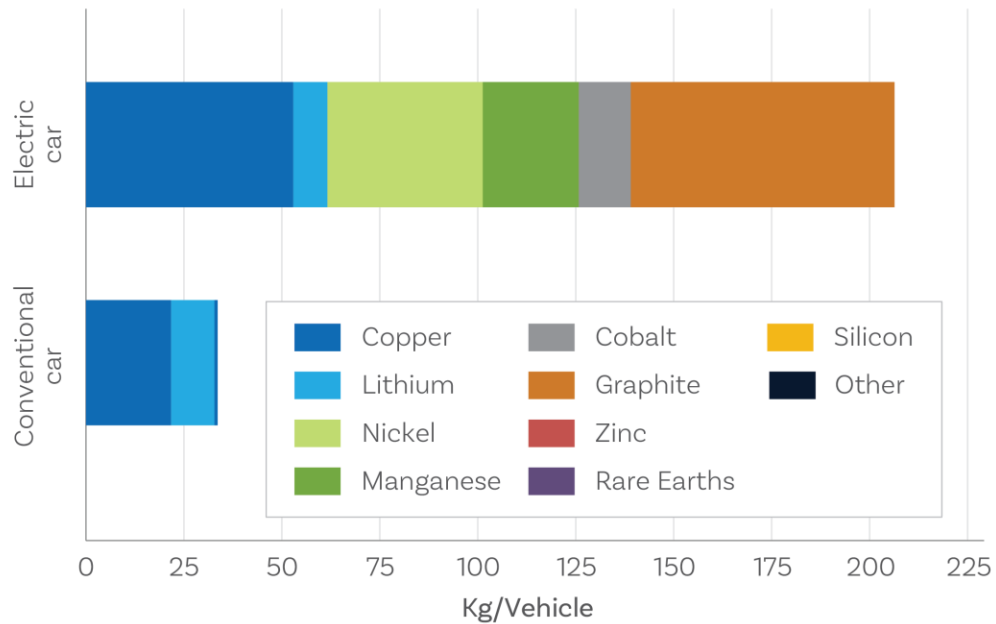
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# Metals and Mining for the Energy Transition



IEA, *Minerals used in electric cars compared to conventional cars*, IEA, Paris <https://www.iea.org/data-and-statistics/charts/minerals-used-in-electric-cars-compared-to-conventional-cars>, IEA. Licence: CC BY 4.0

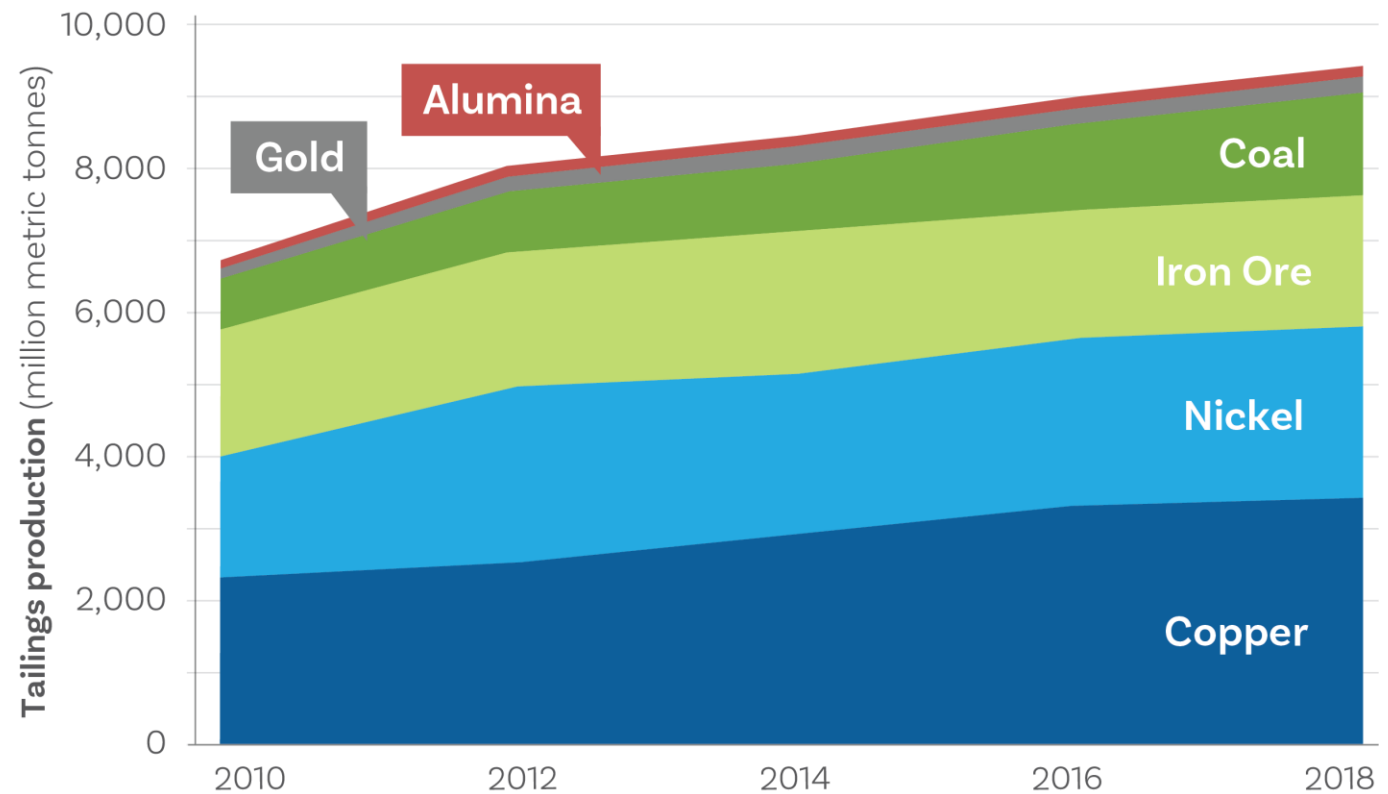
IEA, *Minerals used in clean energy technologies compared to other power generation sources*, IEA, Paris <https://www.iea.org/data-and-statistics/charts/minerals-used-in-clean-energy-technologies-compared-to-other-power-generation-sources>, IEA. Licence: CC BY 4.0



# Mine Waste: Size of the Problem

## Estimate of global annual tailings production by commodity

- 3.4 billion tonnes tailings produced annually from copper tailings in 2018.
- Copper by far the most.
- Declining grades, increasing demand, mean the volume of tails per tonne Cu produced is going up
- Coexisting metals end up in waste



Source: International Council on Mining and Metals; Roadmap for Tailings Reduction, 2022

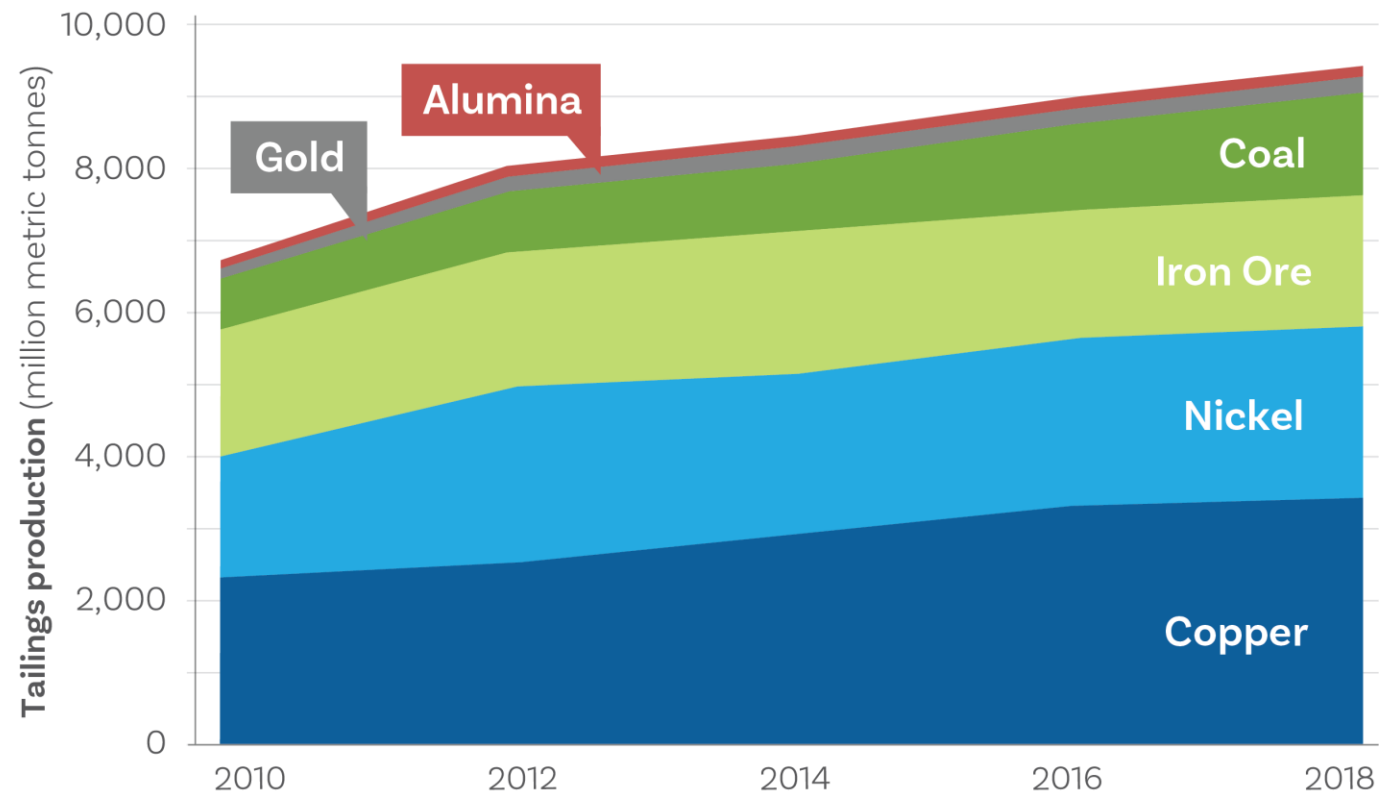


# Mine Waste: Size of the Problem

**OPPORTUNITY**

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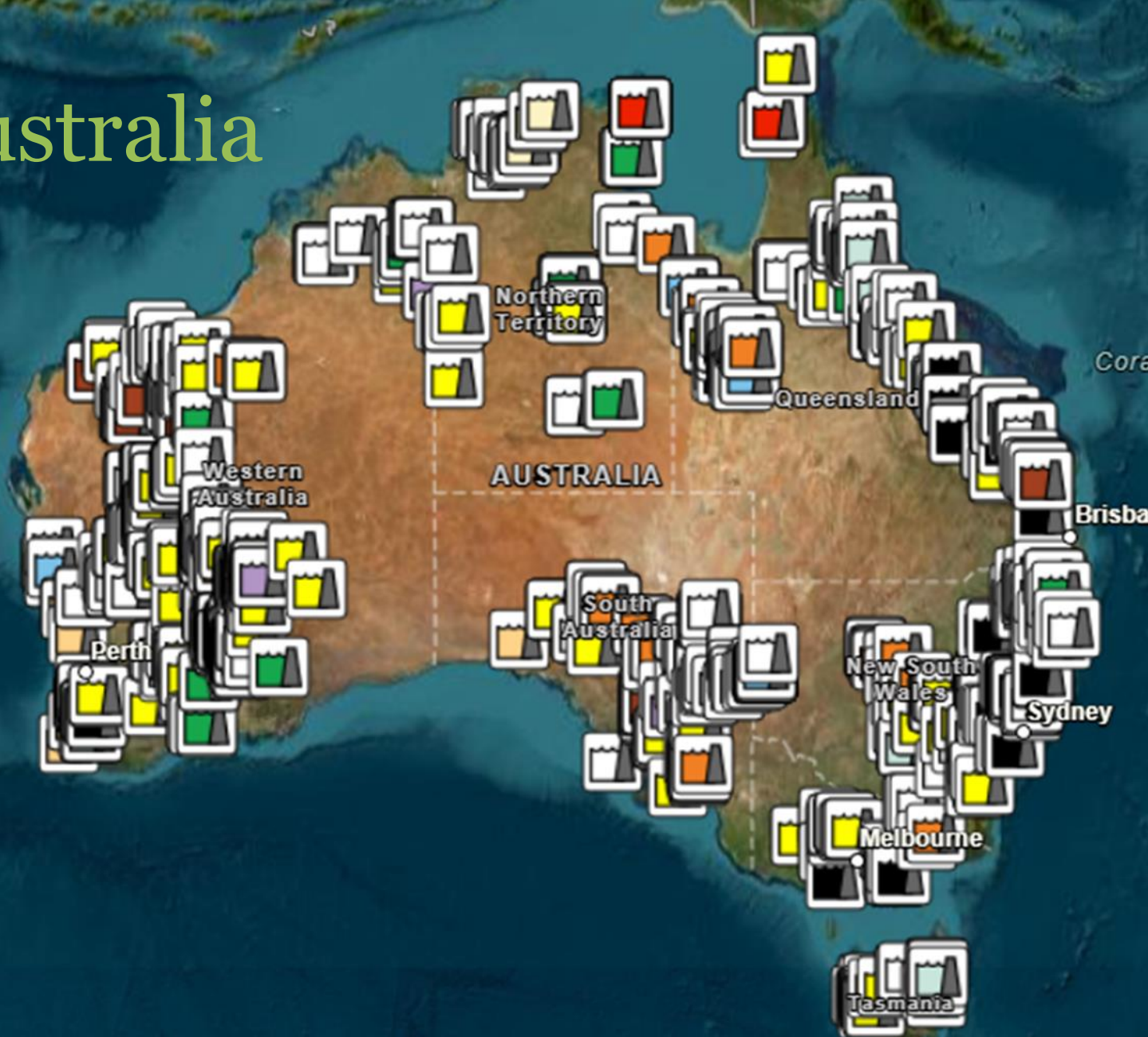


Source: International Council on Mining and Metals; Roadmap for Tailings Reduction, 2022



# Mine Waste in Australia

- Long history of mining
- >3,500 active and inactive sites
- Most will have associated waste
- Potential for valuable raw materials in the waste



# Mining and the Circular Economy

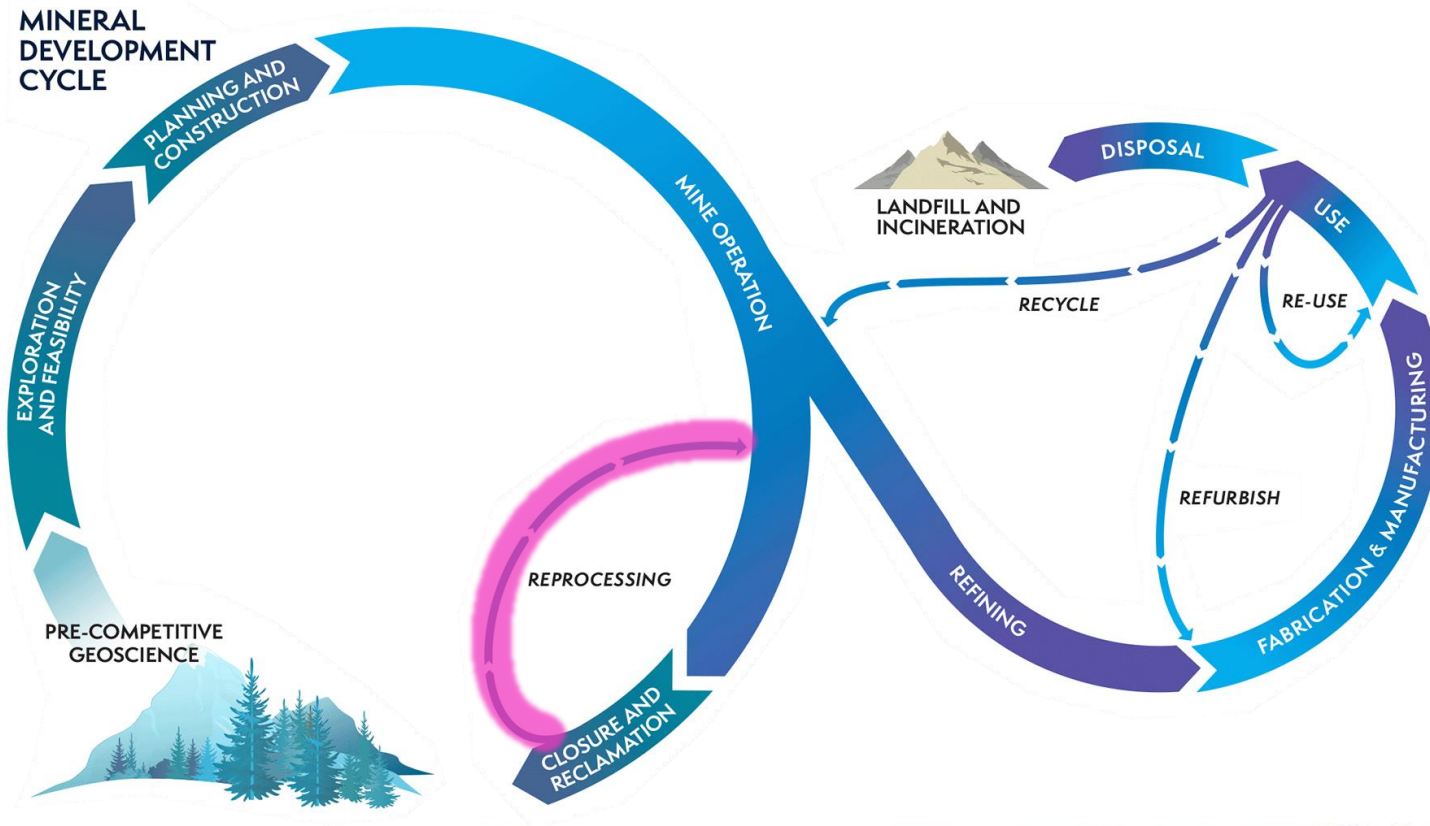


Image credit: Cheatle & Freele, (2020)  
The Northern Miner vol 106



“Mine to battery markets”

## Kwinana

Cobalt Refinery

### Battery Grade Cobalt Sulphate:

- Stage 1 (2025): 3.0 ktpa
- Stage 2 (2026): 4.5 ktpa
- Stage 3 (2027+): 7.5 ktpa

## Broken Hill

Cobalt Project

### Primary Cobalt Resource:

- Mineral Resource of 118Mt\* for 81kt cobalt, targeted project life +20 years
- 3.5 ktpa cobalt (as MHP)
- 300 ktpa Elemental Sulphur

## CWSP

Cobalt in Waste Streams Projects

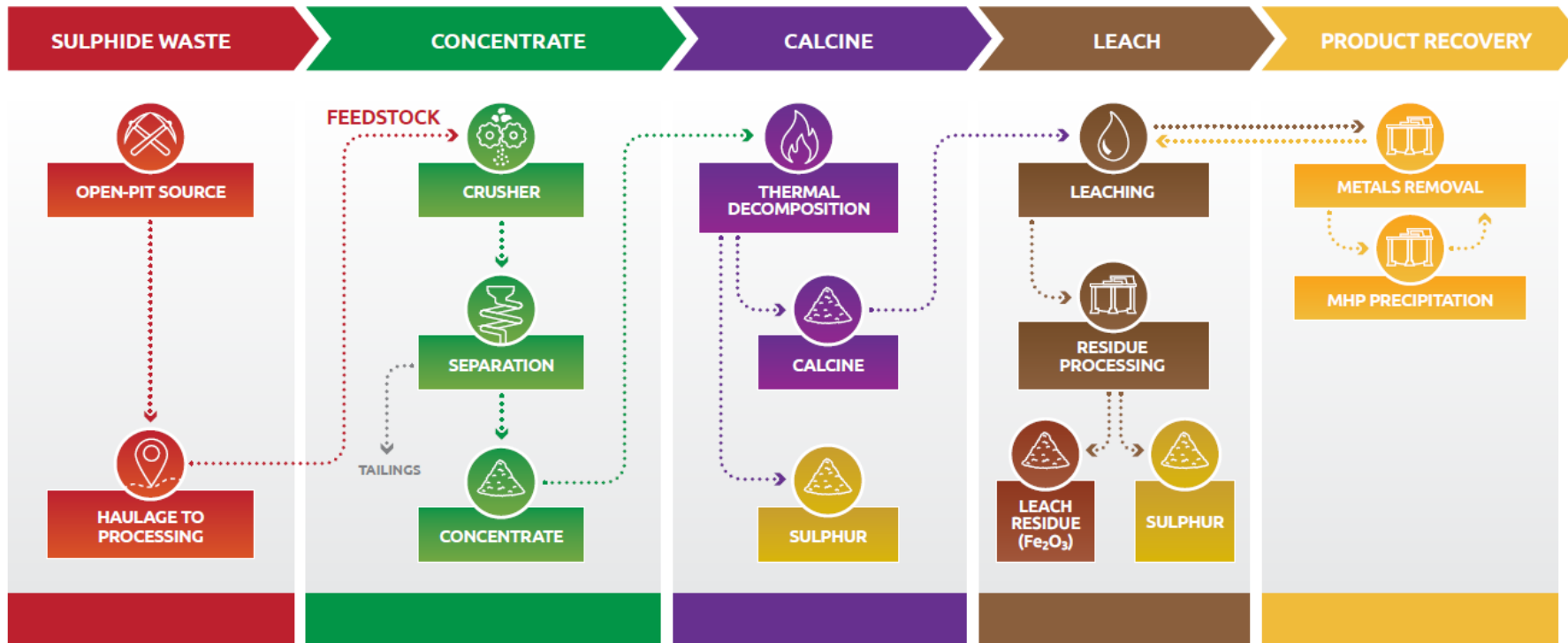
Generate re-mining opportunities of battery metals from mine waste:

- Sustainable mining
- Environmental rejuvenation via removing sulphides
- Flin Flon testwork and other potential projects

\* See Compliance Statement at end of presentation



# COB process



**Produce MHP (Co and Ni), cobalt and nickel sulphate, and elemental sulphur**



# COB process



MHP (30% Co, 7% Ni) & Cobalt Sulphate (20% Co)



Prilled Sulphur



# Cobalt in Waste Streams Projects

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## Project Aim

- To generate opportunities for re-mining of key battery metals from mine waste
- To work with existing operations to develop synergies for secondary metal extraction
- Turning 'trash' into 'treasure', realizing positive environmental outcomes

CWSP

Cobalt in Waste  
Streams Projects



# How we do this?

## Government & academic collaborations

- MOU with Queensland Government and University of Queensland

## Company collaborations

- Working with companies globally to achieve strategic partnerships, testwork agreements and work towards production



# Example: Osborne testwork

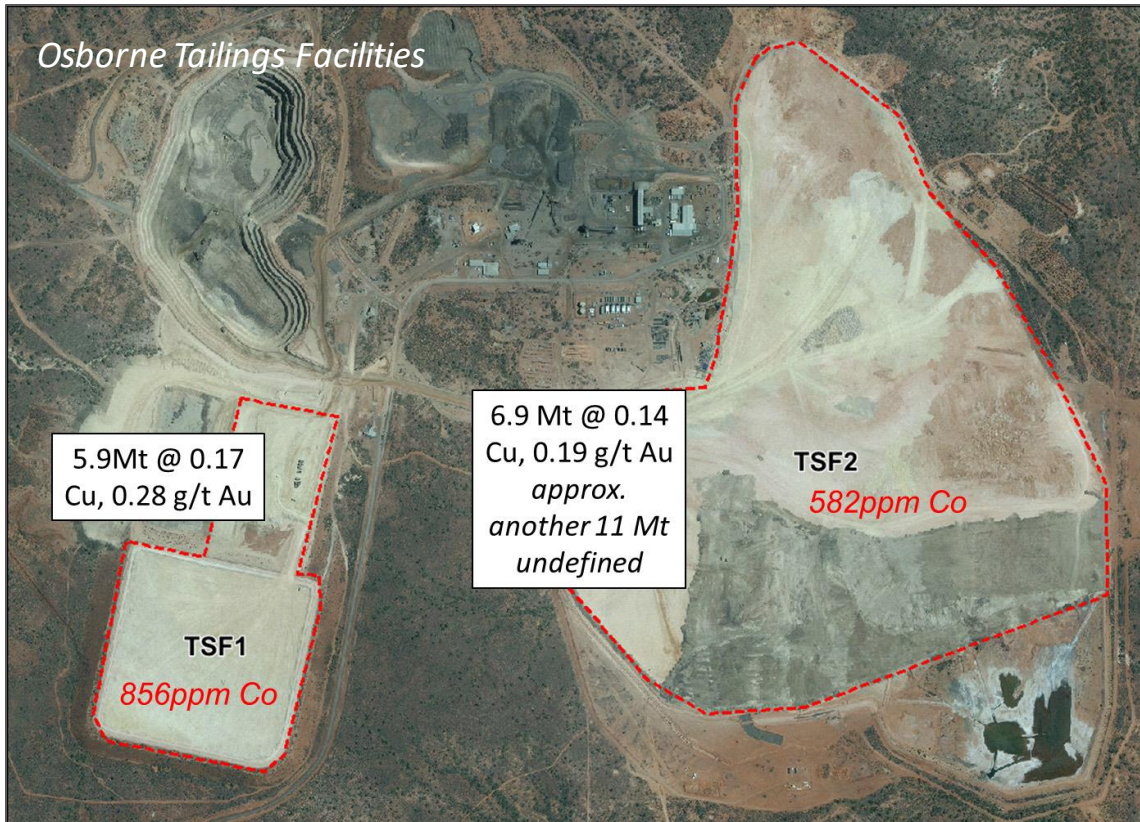


Image credit and sampling data: A. Parbhakar-Fox, University of Queensland.

## Two flowsheets tested:

Tails → float → POX

Tails → kiln → POX (COB Process)

	Float	POX	TOTAL recovery
Cobalt	90%	46%	41.4%
Copper	74%	98%	72.5%

	Kiln	POX	TOTAL recovery
COBALT	99%	90%	89.1%
COPPER	99%	90%	89.1%

Further recovery of cobalt and copper required from leach solutions.

# Example: Flin Flon tailings project

**Market Update**  
26 June 2023

**Cobalt Blue Holdings Limited**  
A Green Energy Exploration Company

ASX Code: **COB**

**Highlights**

**Flin Flon Tailings Testwork Agreement with Hudbay Minerals Inc.**

New South Wales, Australia 2023 – Cobalt Blue Holdings Limited ("COB") (ASX: COB) is pleased to announce that it has entered into a testwork co-operation agreement (the "Testwork Agreement") with Hudbay Minerals Inc. ("Hudbay") with respect to Hudbay's wholly-owned Flin Flon tailings storage facility located in the Province of Manitoba, Canada (the "Tailings Facility").

COB has agreed to utilize its proprietary minerals processing technology to assess the ability to recover gold, silver, copper, zinc, cobalt and sulphur from a pyrite/pyrrhotite concentrate produced from the tailings. COB's proprietary technology offers the potential to convert the sulphides into elemental sulphur, which is stable and benign. The testwork program is expected to take up to 4 months to complete once the tailings sample is received from Hudbay. COB will receive a fee for undertaking the testwork program, which is expected to cover its costs.

In 2021, Hudbay identified the opportunity to reprocess Flin Flon tailings and has recently completed a confirmatory drilling program covering approximately two-thirds of the Tailings Facility (see Hudbay press release dated 2 November 2022 "Hudbay Provides Exploration Update and Announces Initial Mineral Resource Estimate at Laggan", available on Hudbay's website).

**COB Strategy**

COB has recently issued guidance on the rollout of its strategy (see ASX announcement dated 13/02/2023 "COB – CEO's Letter to Shareholders", available on COB's website). This strategy has three building blocks:

1. Broken Hill Cobalt Project ("BHCP")
2. Cobalt-Nickel Railway
3. Cobalt in Waste Streams Project

"Reprocessing mining waste containing pyrite and recovering metals remains a focus for our business. Generally, the opportunities include cobalt-containing pyrite, along with other base and precious metal sulphides such as copper, zinc and gold," said Joe Kaderavsek, COB's Chief Executive Officer.

COB has successfully developed a processing technology for recovering cobalt from pyrite at the BHCP. The 2020 BHCP project update reported cobalt recoveries of 85-98%, from ore to final cobalt sulphate product (see ASX announcement dated 16/7/2020 "Broken Hill Cobalt Project (BHCP) Update 2020", available on COB's website).

COB holds no equity interest in Hudbay or in the Flin Flon Tailings Facility.

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# Co-products in waste

- Copper and nickel mines
  - Cobalt
- IOCGs
  - Cobalt
  - REEs
- Phosphate
  - REEs



# Valorisation and Remediation

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- **Metal production** – increasing resource efficiency and circularity to mining activities.
- **Domestic supply of critical metals** for European battery industry.
- **Produce sulphur** – feeds into fertilizer industry.
- Waste is left with lower acid-forming potential, generating **far better environmental outcomes**.







*Ethical and reliable cobalt  
for a more sustainable world*

ASX: COB

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