



RioTinto

Tailings and waste Valorization Journey

Lessons Learned and successes
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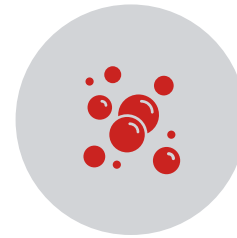
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Behind these outcomes and learnings are dedicated and passionate people from both Rio Tinto and our partners

Tailings attraction



ILLUSION OF
ABUNDANCE OF
RESOURCE



IT'S FREE AND
WITHOUT
LIABILITY TO THE
USER



SOCIETAL DRIVE
TO SUPPORT
SUCH INITIATIVES

Tailings Shortfall

Repurposing waste liabilities

- Remining permitting
- Who carries the risk
- New ultimate waste profile
- Processing cost > Market price

Know your market

- It is not because in country A there is a shortage that you can produce it in country B
- No appetite to develop the market

Engagement model disengagement

- Starts as a wholly independent venture
- Dilutes itself into a process licensor as they progress and see the hurdles

Misunderstanding of what is in them

- Elemental vs Mineralogical content
- Trace elements department
- Solubility vs insolubility

Distance to market

- Most by-products have small economic zones (50 to 200 miles)
- The miraculous ingredient, not accessible

Regulatory approvals

- Great product, no use as no one wants to get it approved
- It costs money and takes time

The Canadian Market – Case Study



ArcGIS - A counting of tailings in Canada

- Canada's opportunities for tailings and mine waste
- Tailings and waste rock production in Canada is 650 Million Tonnes Per Year (MTPY)¹
- Production of main construction commodities:
 - Cement: 14 MTPY²
 - Aggregates : 317 MTPY³
- Production of mine tailing and waste is scattered across Canada and mostly away from urban centers
- Consumers of such commodities are mostly concentrated in two narrow corridors of about 200 miles wide.
- In such a market, producing tailored by-products that fetch at least the logistic-associated costs is important.

1: 2023 - [Waste Rock and Tailings | Mining Watch Canada](#)

2: 2014 - [Joint statement: Canada's Cement Industry and the Government of Canada announce a partnership](#)

3: 2022 - [Annual Statistics of Mineral Production | Natural Resources Canada \(nrcan-rncan.gc.ca\)](#)

Decades of valorization work



Simple uses: Fraction separation for aggregate substitution

Value extraction: Filler material for civil work products and mine backfill

Supplemental cement materials: Fly ash substitution

Geopolymers

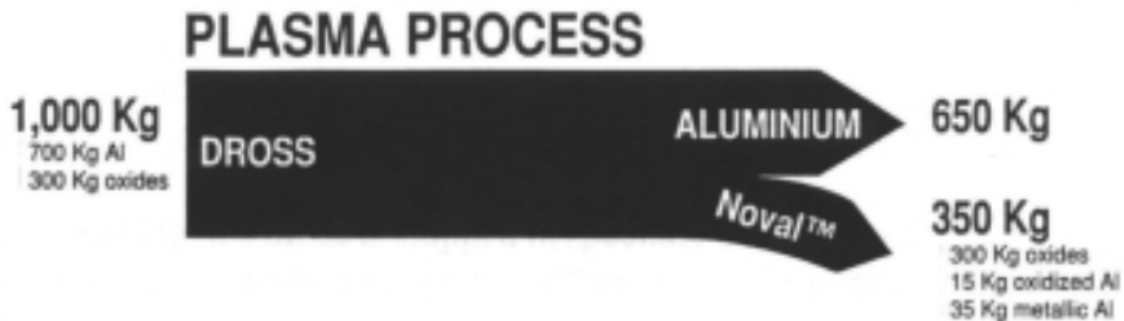
Access to critical minerals

Source of green energy: Noval & Nuton

Value added products from Aluminium Dross and spent pot lining treatment

Noval

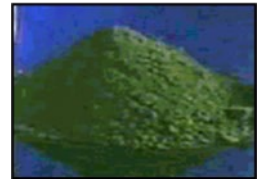
- A by-product from salt free dross processing
- The outcome of a metal value preservation approach
- Initial reuse scenario was to produce calcium aluminates
- Value to cement producer was found by mistake



Five Years of Industrial experience with the plasma dross treatment process
Serge Lavoie & Jacques Lachance – Alcan Smelters and Chemicals Ltd
Third international symposium Recycling of Metals and Engineered Materials
November 12 -15, 1995; Point Clear Alabama

Alextra

- To valorize by-products of Rio Tinto spent pot lining treatment plant
- Spent pot lining product is processed and separated into its constituents:
 - CaF_2
 - Carbonaceous / graphite
 - NaOH
 - Alumina and Silica.
- The result of close collaboration with cement producers



Pictures: RTA – TMS 2016 The LCL&L process

Nuton™

- Leveraging the exothermic oxidation and resulting acid generation from pyrite, which is typically stored in submerged tailings ponds.
- Nuton™ is a bio-heap leaching technology that harnesses the power of bacteria to extract copper from primary sulphides. Minerals make up more than 70% of the world's known copper resources.
- The Nuton™ technologies have the potential to be game changes by making historically difficult-to-leach primary sulphide ores economically viable.
- We accomplish this by achieving industry-leading copper recovery rates of up to 85%, surpassing current industry norms.
- Nuton™ also boasts exceptional sustainability credentials, using less water and energy while maintaining a significantly smaller carbon footprint compared to technologies with similar recovery rates.

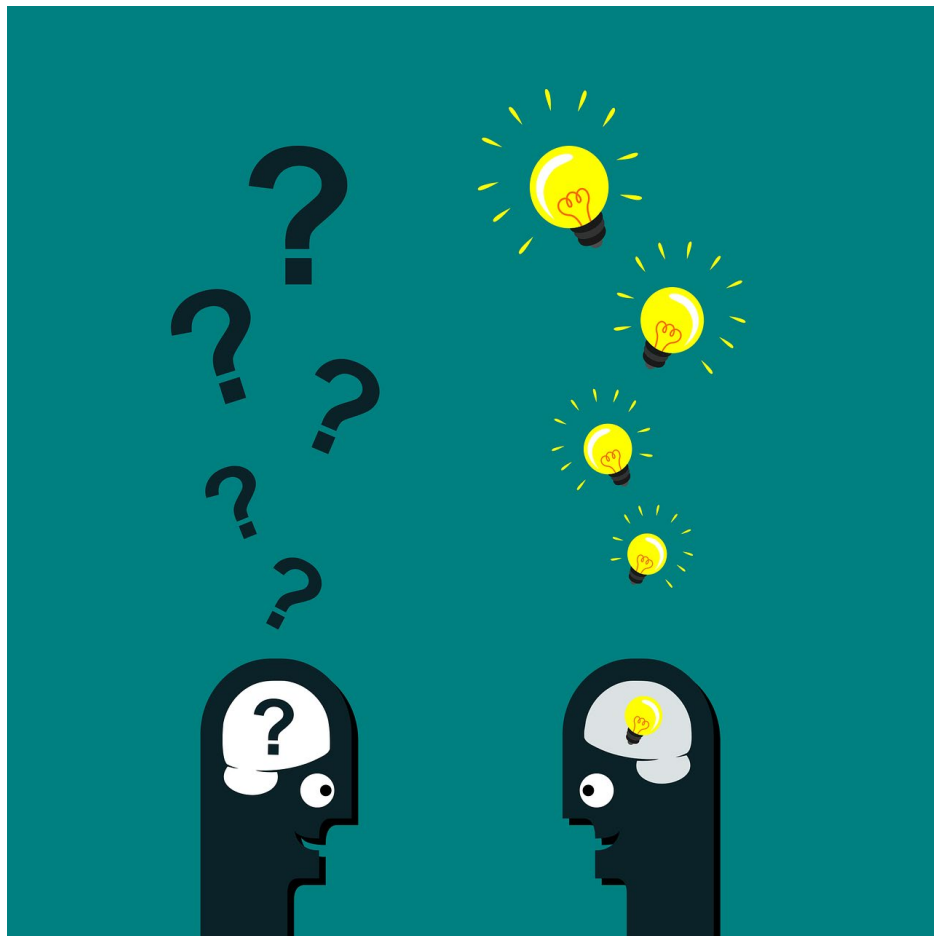
Scientific Pavement

- Collaborative project involving the regulator, university and industry
- Valorize the use of bauxite residues and carbonaceous by-products from spent pot lining
- Initial production batch laid in 2022 at RTA RD&D center in Arvida to evaluate:
 - Technical feasibility
 - Durability with traffic
 - Impacts of freeze and thaw cycles on its integrity
- Undergoing independent regulatory review which would lead to potential certification for public road applications.

We are encouraged by the preliminary results and acknowledge the road ahead to an end use



Failure: Common Hurdles



Black box technologies

No mass balance – wishful chemistry and thermodynamics

Extremely complex processes with ambitious ramp ups

Incomplete business cases

Unrealistic expectations

Product quality

Aggressive processes

Oh! there is a waste stream

Confidentiality

Paths to future success



Transparency

Aim for gems rather than volume

Dedication of resources

Knowledge sharing

Most solutions are local so why see it as a competitive field

Align outcomes to meet economic and environmental criteria and stakeholder expectations

Rio Tinto