Anglo Platinum Base Metal Refinery

Lizelle Kruyswijk

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1981  ➔ Commission new Base Metal Refinery

1994  ➔ Base Metal Refinery upgraded: 19,000 ? 21,500 tpa Ni

2006  ➔ Base Metal Refinery Expansion Initiated: 21,500 ? 33,000 tpa Ni
RBMR Feed

- Nickel 42%
- Copper 29%
- Cobalt 0.5%
- Iron 3%
- Sulphur 24%
Base Metals Refinery Flowsheet

Nickel Circuit
- Nickel - Copper Matte
- Cu Removal
- Pb Removal
- Co Removal
- Ni EW
- S Removal
- To Smelter
- Ni Cathode

Pressure Vessel Liquor
- Primary Leach (CRR)
- Co Plant
- CoSO₄
- Na₂SO₄ Plant
- Na₂SO₄

Leaching Circuit
- Secondary Leach (PLR)
- Leach Residue
- Se Removal
- Cu EW
- Cu Cathode

Copper Circuit
- Cu Cathode
Copper Removal

- First purification step for the nickel electrolyte
- Remove Fe and Cu from primary leach liquor
  - Contacting with fresh matte (NCM)
- Oxidative and hydrolytic reactions
- Oxygen supplied by enriched air
- Temperature: 70 - 90°C
Primary Leach

- Maximise selective Ni dissolution to primary leach liquor
- Heazlewoodite ($\text{Ni}_3\text{S}_2$)  Millerite (NiS)  Nickel sulphate ($\text{NiSO}_4(aq)$)
- Sherritt Gordon technology – 2 x horizontal autoclaves
- Compartment 1 & 2  oxidative Ni dissolution
- Compartment 3 & 4  non-oxidative Ni dissolution (Metathesis)
Secondary Leach

- Extraction of Cu and Ni
- Allow for Fe to exit as a residue
  - Hematite (Fe$_2$O$_3$)
  - Jarosite (2NaFe$_3$(SO$_4$)$_2$(OH)$_6$)
- Sherrit Gordon Technology – 3 x horizontal autoclaves
- Enriched air
- Cooling supplied by:
  - Compressed air
  - Cooling coils
  - Recycled copper electrowinning spent electrolyte
Lead Removal

- **Source of Lead**
  - Pb anodes
  - PbS in NCM

- **Reagent:** Barium Hydroxide

- Reagent inserted in pipe reactor

- Tank Reactor for residence time (Nucleation)

- Filter cake (PbSO$_4$) sent to smelter
Cobalt Removal

- Outokumpu process
- Nickelic hydroxide as reagent
  - Old technology
  - Efficient Impurity Scavenger
- Ni(OH)$_2$ and Co(OH)$_3$ precipitate
- Ni(OH)$_2$ redissolved with Ni Spent
Cobalt Sulphate Plant

Feed

Cobalt Dissolution

Impurity Removal

Solvent Extraction

Cobalt Crystallization

CoSO₄ crystals
Cobalt Solvent Extraction
Nickel Electrowinning

- Manual operation
- Pb – Sr (0.05 %) – Sn (0.6%) anodes
- Starter sheet (titanium blanks)
- Current density 220A/m²
- Cathode bags
- Boric acid
  - pH buffer
  - smoothing agent
Sulphur Removal

- Final sulphur removal step
- Water recovery
- 2-stage precipitation with NaOH
Sodium Sulphate Plant

- Crystallisation of Na$_2$SO$_4$
- 55,000 tpa Na$_2$SO$_4$
- Sold to detergent manufacturers
Selenium Removal

H/X (95°C) → Reduction (Pipe reactors) → Oxidation → Copper Feed Ageing Tanks → Filtration → Se, Te Residue

Secondary Leach Solution → Sodium Sulphite → Air
Selenium Removal
Copper Electrowinning

- Manual operation
- Pb-Sb(6%) Anodes
- Starter sheet (titanium blanks)
- Current density 190A/m²
  - No circulating flow
  - Cu bite 35g/l
- Guar
  - Smoothing agent
BMR Expansion Plans

• Change in leach configuration
  - Dedicated Fe removal stage

• New Ni tankhouse
  - Automated harvesting and stripping
  - Full-deposit plating (Ti blanks, permanent edge strips)
  - Mist abatement

• Added ageing capacity for Selenium Tellurium Removal