NORTHAM
PLATINUM LIMITED

Technological solution to improvement in PGM recovery, upgrade ratio and Cr_2O_3 reduction of UG 2 ore

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Introduction

- MF 2 – concentrator @ 75 000 t / month
- Outokumpu tank cells
- PGM recovery not up to design specification
- Cr_2O_3 a problem during smelting

Parameter	Design	Actual
PGM recovery	85 %	80 %
Cr_2O_3 in conc.	2.0 %	4.5 %

Introduction

- Options investigated to reduce Cr_2O_3 :
  - Depressant, frother, reduced mass pull
- Past experience suggested using a flotation column as re-recleaner to achieve the necessary selectivity
- Pilot plant was acquired and trials commenced using the column as re-recleaner

Pilot plant trials
Method

Key performance indicators :

- PGM recovery
- PGM upgrade ratio
- PGM / Cr_2O_3 ratio in concentrate

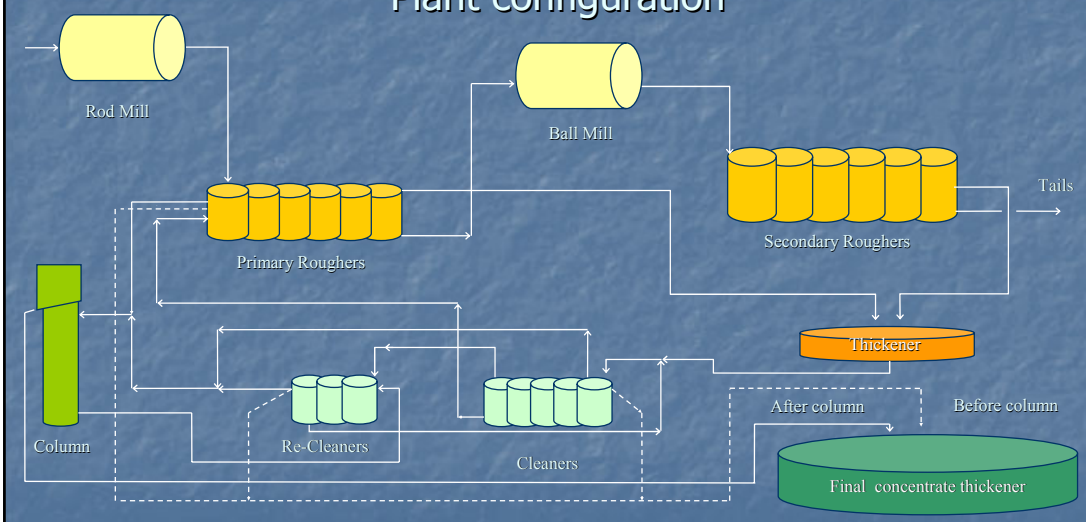
Pilot plant trials
Method

- Operating parameters identified
  - *Air addition*
  - *Pulp level*
  - *Slurry feed rate*
- Conditions set – parameter chosen
- Parameter varied across operating range
- Composite samples collected at each setting

Pilot plant trials
Method

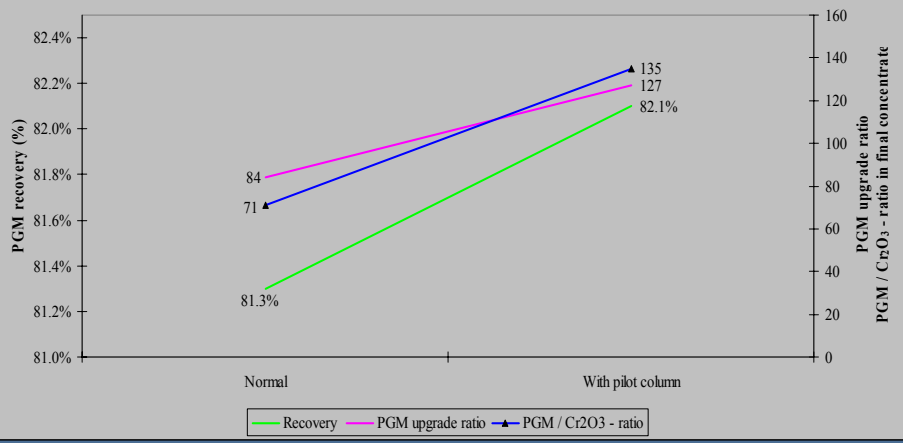
- Samples assayed : 315 composites
- Results evaluated
- Plant trial : Pilot plant as re-recleaner
- Total duration of trials : 31 days

Pilot plant trials
Plant configuration



Pilot plant trials
Plant metallurgical results obtained

Comparison between normal plant operation and operation with pilot plant as re-recleaner (Figure 3)



Pilot plant trials

Plant metallurgical results obtained

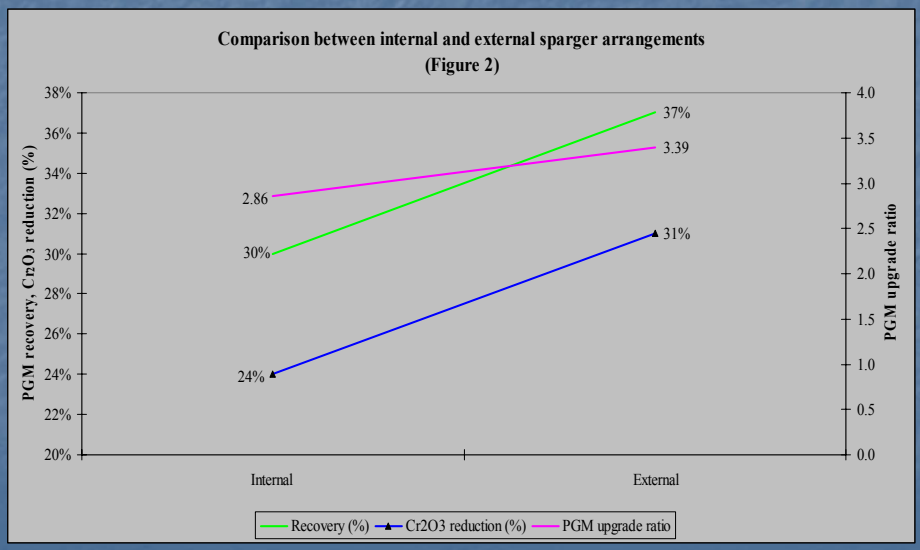
- PGM recovery : + 0.98 %
- PGM upgrade ratio : + 51.2 %
- Cr_2O_3 in conc. : - 20.8 %
- PGM / Cr_2O_3 ratio : + 90.1 %

** Internal sparger used*

Pilot plant trials

Comparison between internal and external sparger

Column performance



Pilot plant trials

Comparison between internal and external sparger

Column performance

- PGM recovery : + 23.3 %
- PGM upgrade ratio : + 18.5 %
- Cr_2O_3 reduction : + 29.2 %
- PGM / Cr_2O_3 ratio : + 25.7 %

* *Data collected during Merensky trials*

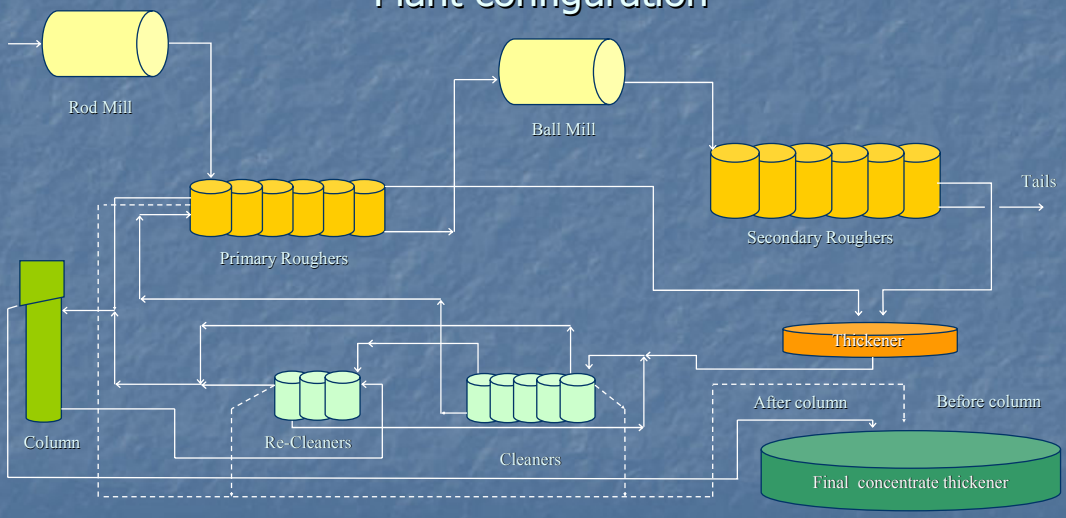
Pilot plant trials

Conclusions

- Significant reduction in Cr_2O_3 possible
- Improved PGM grade
- Improved PGM recovery
- External sparger more efficient than internal

Installation of external sparger column

Plant configuration



Installation of external sparger column

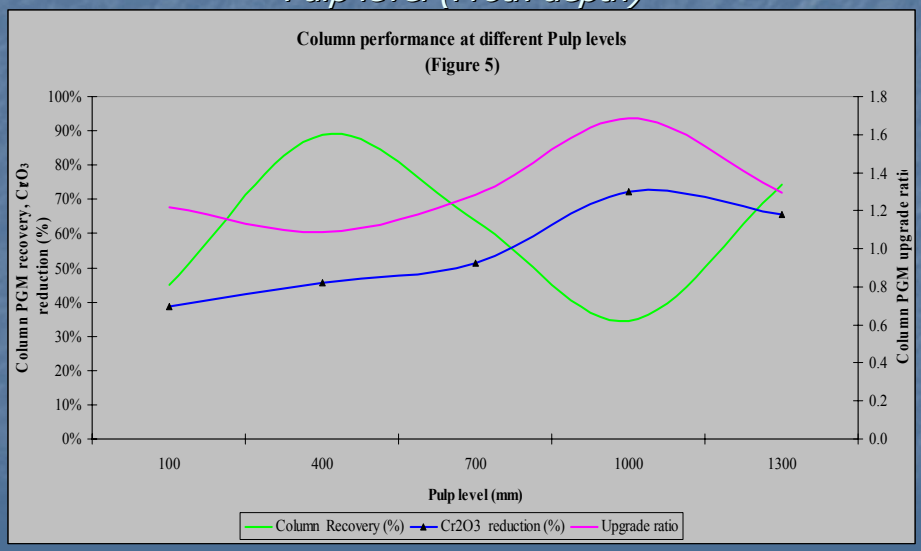
Optimization – Method

- Parameters maintained at standard
- One parameter evaluated per trial
- Procedure as for pilot plant trials
- Standard settings :
  - *Pulp level :* *700 mm*
  - *Air addition :* *65 Nm^3/hr (J_g= 1.2 cm/s)*
  - *Sparger pressure :* *2.0 bar*

Installation of external sparger column

Optimization

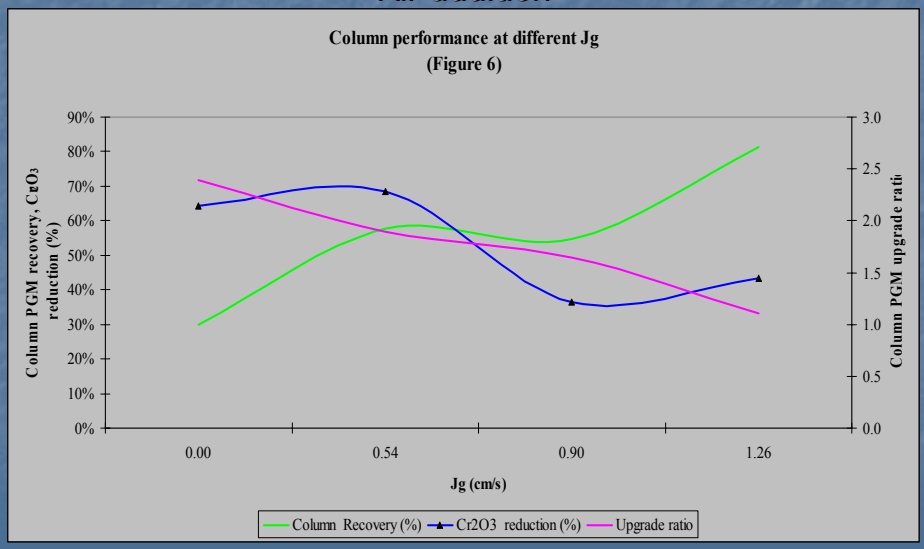
Pulp level (Froth depth)



Installation of external sparger column

Optimization

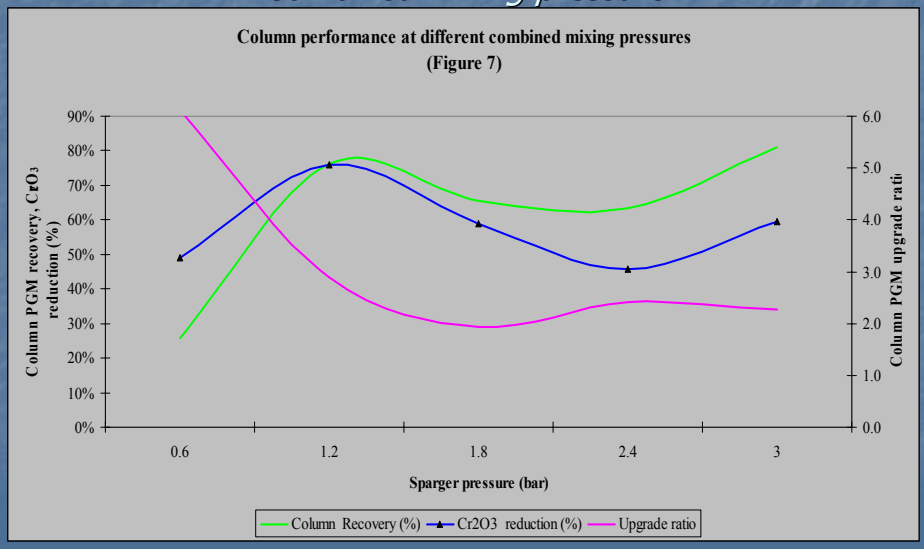
Air addition



Installation of external sparger column

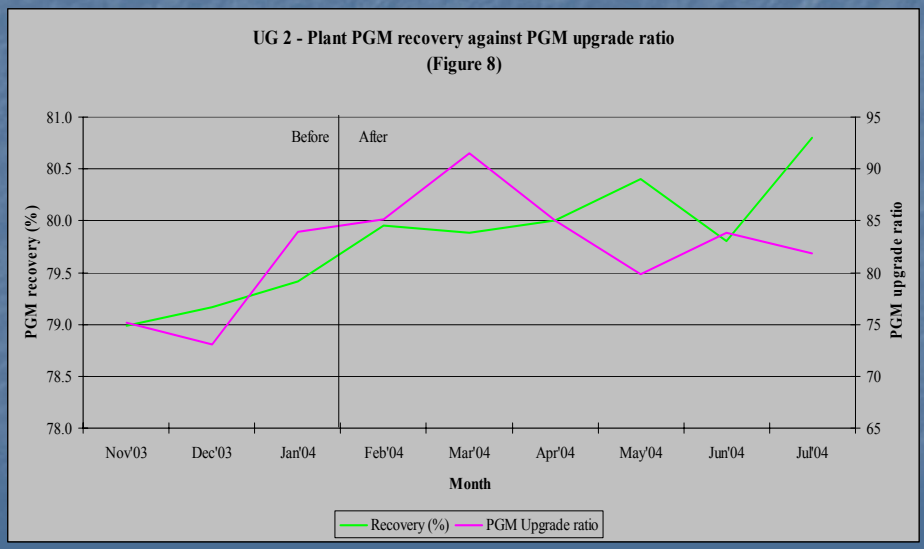
Optimization

Combined mixing pressure



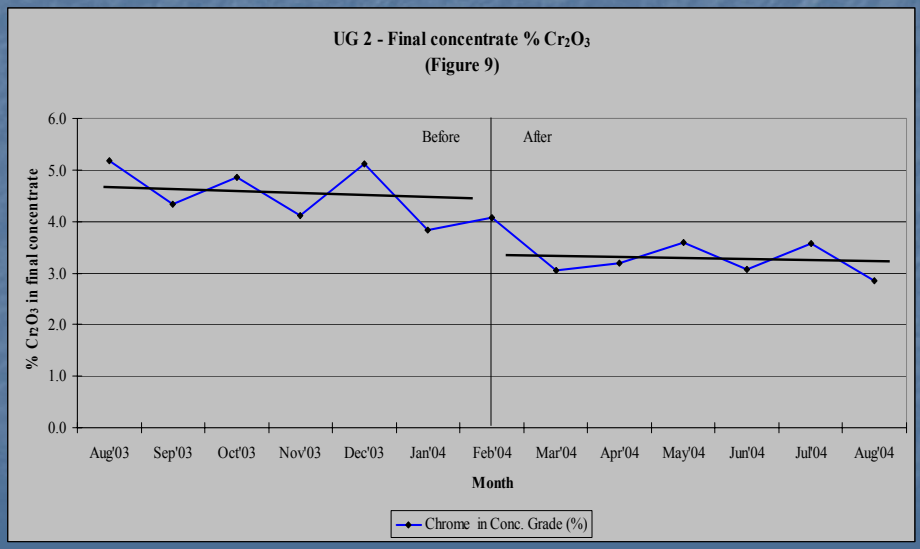
Plant metallurgical performance - after

PGM recovery & PGM upgrade ratio



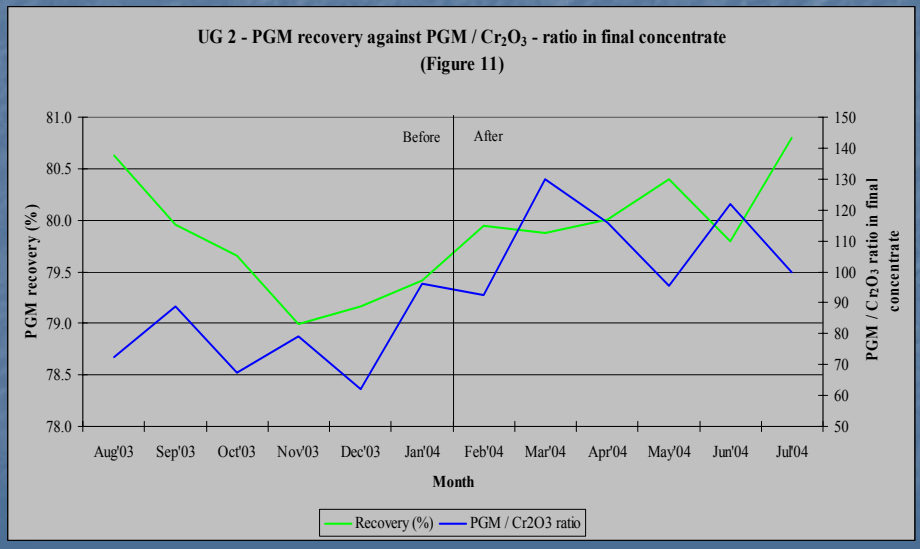
Plant metallurgical performance - after

Final concentrate % Cr_2O_3



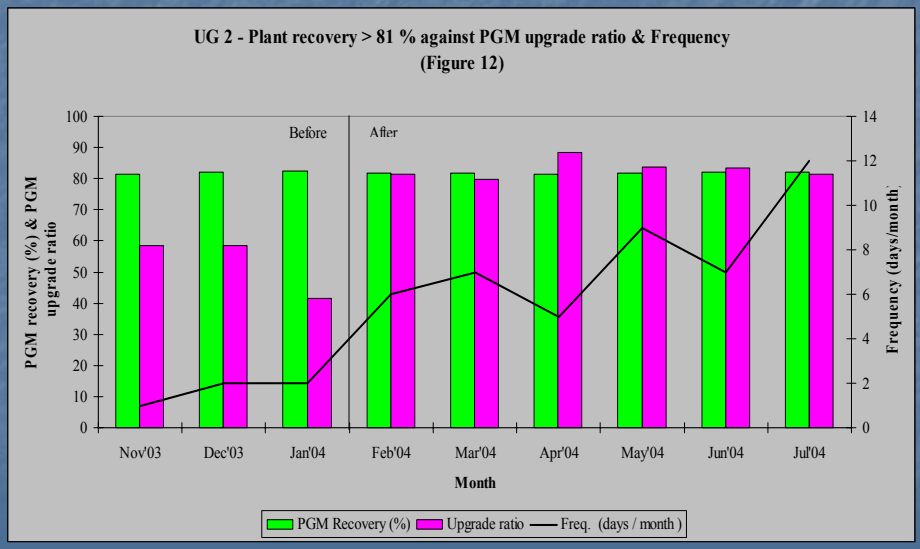
Plant metallurgical performance - after

PGM / Cr_2O_3 ratio



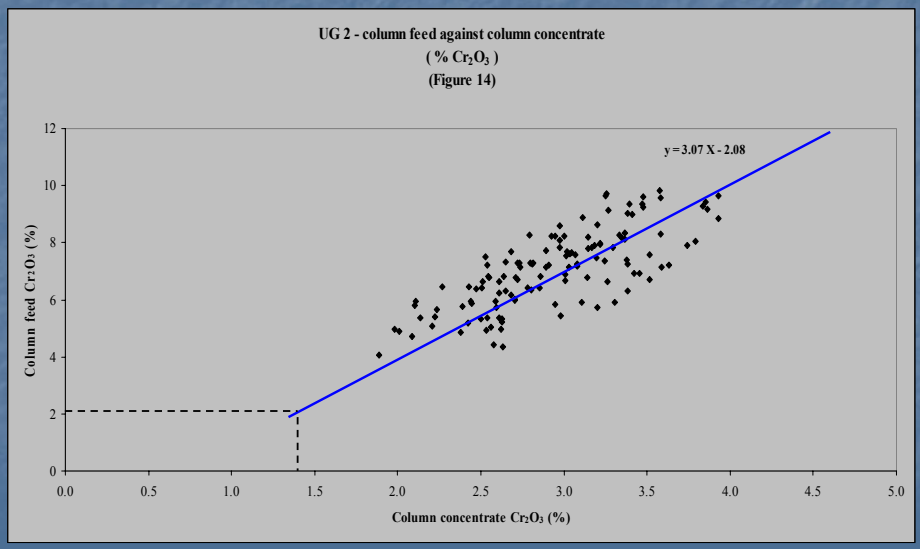
Plant metallurgical performance - after

PGM recovery & upgrade ratio vs frequency



Plant metallurgical performance - after

Column Cr_2O_3 reduction



Plant metallurgical performance - after
Results obtained – overall

- PGM recovery : + 2.0 %
- PGM upgrade ratio : + 9.0 %
- Cr_2O_3 in conc. : - 37.8 %
- PGM / Cr_2O_3 ratio : +76.3 %
- Plant throughput : + 9.5 %

Conclusions

- Typical Cr_2O_3 penalties payable :

Cr_2O_3 in concentrate (%)	Smelting penalty (ZAR / ton Cr_2O_3)
< 1.5	0
1.5 – 2.0	13200
2.0 – 2.5	14600
2.5 – 3.0	16100
3.0 – 4.0	32200
4.0 – 5.0	50000
> 5.0	75000

Conclusions - Payback

	Before	After	Comments
Plant feed	**100 000**	**100 000**	@ 4.0 g/t 3PGE + Au
Recovery	80.0 %	81.6 %	Increase by 2 %
Conc. Grade	340 g/t	375 g/t	Improve by 10 %
Cr_2O_3 in conc.	4.5 %	2.8 %	Reduce by 38 %
Penalty	ZAR 50 000	ZAR 16 100	Per ton Cr_2O_3 in concentrate
Additional income	ZAR 832 000		At ZAR 130 000 / kg 3PGE + Au
Penalty saving	ZAR 1 757 120		Including smelting saving (ZAR 450 / t) Excluding transportation saving
Profit	**ZAR 2 589 120**		
Capital expenditure	ZAR 1 700 000		

Conclusions

The external sparger column exceeded all expectations :

- PGM recovery improved by 2 %
- PGM upgrade ratio of 105 achieved
- Potential reduction of 38 % of current UG 2 final concentrate Cr_2O_3 content

Conclusions

Is this Northam proven technology the answer to Cr_2O_3 associated challenges in pyrometallurgical processes ?

Acknowledgements

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