

*Impala's Fixco process and the associated One team - one vision philosophy has delivered significant improvements in productivity. Impala is the leader in production efficiencies in South African hard rock mining. The year ahead will see an increased effort at rejuvenating this process, to deliver further improvements in the future.*

*Here, Drew Waddle operates a jumbo drill rig, developing the triple decline system at Impala's 11 shaft.*

“ Over the past decade Impala has undergone a revolution in its operating philosophy resulting in its transformation from a high cost producer to the lowest cost primary producer in the industry. ”



**John Smithies**  
Operations Director

Review by business unit or interest

# Impala Platinum

## Renewed focus on performance

Implats' major operating asset is Impala Platinum Limited (Impala), located on the world-renowned Bushveld Complex. Impala's 13 operating shaft systems and Mineral Processes are near the towns of Rustenburg and Phokeng, whilst the Precious Metals and Base Metals Refineries are near Springs, in Gauteng.

Over the past decade Impala has undergone a revolution in its operating philosophy and practices resulting in its transformation from a high cost producer to the lowest cost primary producer in the industry, with the best productivity statistics of all South African hard rock mining, gold and platinum combined.

### Steady operational performance

The year in review saw a mixed performance from the Impala operations. The extra holidays over the

Christmas/New Year period, along with planned Y2K shutdowns, resulted in a less than optimal start to operations for the second half of the year, following a reasonable performance in the first half. Extraordinarily high rainfall in the Rustenburg area, which led to a conveyor collapse at Minpro and other operational problems, combined with a higher than normal labour turnover and two full-day national strikes, increased pressure on operational performance.

In addition, development was deliberately increased by 14 per cent to 211 000 metres, to open up ore reserves for future stoping and to ensure overall optimal extraction of the ore body. This was timed during a year in which we could afford it. This increased development had a dilutive effect on the head grade since much of the development was on the reef horizon.

		2000	1999	1998	1997	1996
Tons milled	('000)	14 662	14 638	14 509	13 775	13 475
% UG2 mined		50.6	48.1	45.9	45.6	51.8
Headgrade (g/t 5 pge + Au)		5.0	5.3	5.2	5.2	5.3
m <sup>2</sup> per stoping employee per month at work		40	41	40	36	34
Tons per employee		51	51	48	44	42
Number of employees in service ('000)		28.3	28.7	29.5	31.0	31.1

Mining statistics

“ The Fixco process has proved to be a resounding success. The fruits of the process were the development of an affordable long-term mining plan, coupled with a 10 per cent reduction in cost per kilogram over the past three years. ”

– Paul Visser

**Bob Greer**  
Consulting Mechanical & Electrical Engineer



**Paul Visser**  
Consulting Engineer Mining

With the co-operation of labour representatives, the year-on-year reduction in employee numbers continued its downward trend to 28 300 by the end of the financial year. Productivity levels continued at existing levels without major improvements for the first time since 1992. Together with a shortfall in production this resulted in a marginal year-on-year decrease in productivity per stoping employee from 41 in 1999 to 40 centares per man in 2000.

Measures have been put in place to ensure continuous improvements are again achieved in the years ahead. Employee numbers are expected to continue to decrease, mainly through natural attrition, albeit at a slower rate than in the past.

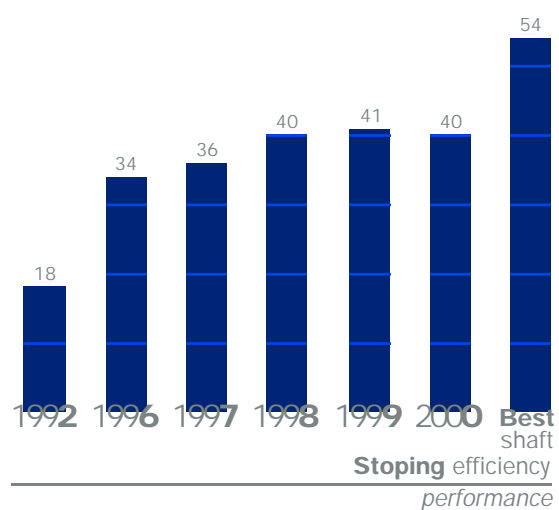
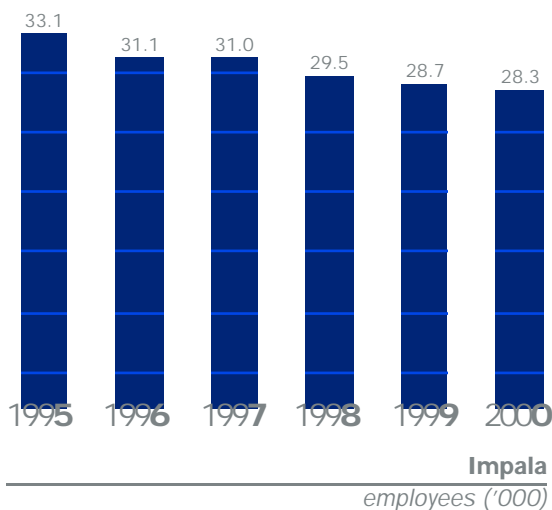
### One-team one-vision

Four years ago Impala introduced the Fixco process, which had as its central theme One-team one-vision. The aim of Fixco was to secure Impala’s long-term future through a real reduction in unit costs. This was to be achieved by creating the workplace conditions that would enable the identification and implementation of cost per kilogram improvements.

The Fixco process has proved to be a resounding success. The fruits of the process were the development of an affordable long-term mining plan, coupled with a 10 per cent reduction in real cost per kilogram pge over the past three years.

During the year, Impala recognized that the Fixco initiative was losing momentum. It is understandable that the energy imbued in the process will dissipate over time. Contributory factors include the fact that certain of the initiatives embarked on were “once-off” where immediate benefits could be achieved.

To re-energise the process our combined management-employee team has identified a number of new initiatives and involved new team members to bring the process back on track. Our Best Practices and “Fetoga” (change) initiatives will continue to underpin the process to regain the momentum in the future.



“ Not only is the mining plan extremely capital efficient, but the concentration of mining across the decline shafts will reduce the overheads associated with operating 13 shaft systems. ”

– Francois Naudé

Johan Muller      John Strauss  
Rustenburg Finance      Springs Finance



Francois Naudé  
Senior Manager Finance

## Good progress with decline projects

Impala's current operations span 13 shafts, but the longer-term mining plan involves the development of a series of six decline shaft systems below the current third generation vertical shafts. This will allow a gradual move into the lease extension area and access to reserves capable of sustaining Impala's production levels at 1.0 to 1.1 million ounces of platinum for the next 35 years and beyond.

The average depth of mining will only increase from about 600 metres at present to 850 metres in about 10 years time, which is shallow in the South African hard rock mining context and compares favourably with pgm-producing peers. In a 20-year time horizon, reserves down to 1 400 metres will be accessed without any change in mining methods, nor any substantial increase in mining costs.

Not only is the mining plan extremely capital efficient, but the concentration of mining across the decline shafts will reduce the overheads associated with operating 13 shaft systems. There are four decline projects currently in progress (1, 10, 11 and 12 Shafts) with the main sinking phases at various stages of completion. The 14 Shaft decline project will commence its main sinking phase in November 2000.

- Development of the 10 Shaft decline was begun in 1996 and will be completed in September 2001. This triple decline system comprises conveyor and chairlift declines, as well as a material incline shaft. The decline system will service four mining levels, mining Merensky reef initially and migrating to the UG2 reef as Merensky ore is depleted. Stopping operations are already in progress on the first two levels, whilst ore reserve development is in progress on the third. Station development and construction on the fourth

level as well as the development of the remaining conveyor belt leg is currently in progress.

- The 1 Shaft decline sinking project began at the end of 1997 and has progressed to the cutting of the station on the third level. Stopping has commenced from the first decline level and ore reserve development is in progress on the second level. This twin decline system, which has a conveyor decline and a chairlift/material decline, pioneered the use of the first electric monorail transport system in a hard rock underground mine.

Although the first level was timeously attained, a zone of very weak rock strength was entered in developing down to the second level, which slowed advance rates and necessitated a revision of the support strategy. The project is therefore currently six months behind the original schedule; this will not have a negative impact on the planned production from 1 Shaft.

The project has been modified from a six level decline to a four level decline, which will allow earlier mining on these levels than originally planned. The deeper ore reserves will form part of a next phase in the decline shaft strategy and has been planned as such in the 30-year planning scenario. The decline sinking and station development is scheduled for completion in 2003.

- The 11 Shaft decline, a triple decline system comprising conveyor, chairlift and material declines, commenced with main sinking operations in 1999. This four-level project, which will mine the Merensky and UG2 reefs simultaneously, has reached the first level and station development has commenced. Main sinking is due for completion in 2004.



*Abel Matabane, Plant Shift Leader, overlooks Impala's Minerals Processes' Merensky Flotation Plant. Comprising 18 tank cells of 130 m<sup>3</sup> each, this newly commissioned plant constitutes the largest and most effective of its kind. Expectations are that recoveries of up to 91 per cent will be achieved through further optimisation.*

Included in this project is an upgrading of the current 11 Shaft infrastructure to enable an increase in production capacity of some 50 per cent. The enlargement of the headgear and building of surface ore transfer silos have already been completed. A new rock winder is being installed and will be operational by September 2000. Piloting of the raise bore hole for additional ventilation capacity is complete and reaming of the hole is in progress.

- The 12 Shaft South decline project, comprising a twin shaft system, commenced sinking in February 2000. Material will be lowered and raised on a rail track by means of a single drum winch located adjacent to the conveyor belt for ore transport. This three level decline, which will initially mine Merensky reef and later UG2 reef, will be completed by 2004.
- The largest decline project to date, the 14 Shaft decline, is in the process of establishing multi-blast ventilation facilities and a conveyor to handle broken rock from the main sinking contract, which will commence in November 2000. This project also includes the upgrading of hoisting facilities, surface ore transfer silos and additional ventilation capacity to enable an increase of shaft capacity by 40 per cent.

This will be a quadruple decline system, with a conveyor decline, material decline, as well as high- and low-speed chairlift declines. Completion of this five level project, which will mine Merensky and UG2 reefs simultaneously, is scheduled for 2006.

## Impala reserves and resources for 35 years and beyond

Mineral reserve and resource data classification is based on the South Africa Code for Reporting of Mineral Resources and Mineral Reserves (the Samrec code) which sets out the minimum standards recommended and guidelines for public reporting of exploration results, mineral resources and mineral reserves in South Africa. Note that the Mineral Reserves quoted, in terms of this code, reflect the grade delivered to the mill rather than the in situ grade quoted in respect of Mineral Resources.

Extensive underground sampling, surface drilling, 2-D and 3-D seismic surveys have provided us with confidence in the geological structures and in the mineral reserve and resource estimates indicated below.

Orebody	Category	Tonnage (millions)	Grade (5 pge&Au)	Pt oz (millions)
Merensky	Proven	16.5	4.85	1.5
	Probable	95.6	4.83	8.4
UG2	Proven	19.0	5.03	1.5
	Probable	138.7	5.08	10.8
Total		269.8	4.97	22.1

**Impala** lease area ore reserves  
Mineral Reserves as at 30 June 2000

Definitions: A Mineral (or ore) Reserve is the economically mineable material derived from a measured and/or indicated mineral resource. It includes marginally economic and diluting materials delivered for treatment and allows for losses that may occur during mining. Appropriate assessments have been carried out, including realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate that, at the time of reporting, extraction is reasonably justified. Mineral reserves are subdivided, in order of increasing confidence, into Probable Mineral Reserves and Proven Mineral Reserves.

**Proven Reserves:** Proven Reserves refers to material available for mining without further development.

**Probable reserves:** Probable Reserves describes material beyond existing development, which has been evaluated by drilling and seismic surveys and for which appropriate feasibility studies have been completed which confirm economic extraction.

pge: This refers to total individual platinum group elements, namely, Pt, Pd, Rh, Ru and Ir.

Orebody	Category	Tonnage (millions)	Grade (5 pge&Au)	Pt oz (millions)
Merensky	Measured	-	-	-
	Indicated	132.9	7.77	18.8
UG2	Measured	3.5	9.17	0.5
	Indicated	83.0	9.32	11.8
Total		219.4	8.38	31.2

**Impala** lease area ore resources  
Mineral Resources as at 30 June 2000

Definitions: A Mineral Resource is a concentration of material of economic interest in such a form, quality and quantity that there are reasonable and realistic prospects of eventual economic extraction. The location, quantity, grade, continuity and other geological characteristics of a mineral resource are known, estimated from specific geological evidence and knowledge, or interpreted from a well-constrained and portrayed economic model. Mineral Resources tonnage excludes diluting materials and allows for geological and mining losses anticipated. Mineral Resources are subdivided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories.

**Measured Mineral Resources:** Measured Resources includes material where geological evaluation has been completed and appropriate feasibility studies are in progress.

**Indicated Mineral Resources:** Indicated Resources include material where the continuity of mineralisation can be assumed but where additional geological evaluation is required.

The Measured and Indicated Mineral Resources are additional to Mineral Reserves.

A limit of 1 750 metres below surface has been placed on the Mineral Reserve and Mineral Resource calculations. Continuity of mineralisation below this depth has been confirmed by limited borehole information. These resources can be classified as Inferred but have not been quoted.

“ Implats' Enhanced Precious Metals Refinery is now arguably the lowest cost precious metals refinery in the world. ”  
 ~ Dirk Theuninck

**Geoff Skelton** Consulting Engineer Refineries  
**Gary Highcock** Consulting Engineer Metallurgy



**Dirk Theuninck**  
 Senior Consulting Engineer Metallurgy

## Metallurgical improvement increases competitive edge

Impala continues to dedicate significant attention and resources to maintaining the leading edge in its metallurgical operations with significant capital expenditure programmes during the year in the areas of concentrating and smelting.

### Concentrator

The Merensky Flotation Plant comprising 18 tank cells of 130m<sup>3</sup> each, constitutes the largest and most cost-effective plant of its kind in the industry and pgm recoveries from this newly commissioned plant – at 89 per cent - already compare favourably with competitors. Expectations are that still higher values – as high as 91 per cent – can be achieved through further optimisation. The current focus is to achieve more stable operation through consistent mill product quality, the installation of woodchip screens and further refinements to the reagent suite.

In line with Impala's aim of improving UG2 ore recovery (which is usually more difficult to treat because of its mineralogical properties), work has begun on the installation of an autogenous milling circuit at Mineral Processes. Construction of this R100 million project is due to begin in August 2000, with hot commissioning in March 2001. Project deliverables for the new UG2 Plant include a five per cent increase in pgm recovery, a 30 per cent increase in capacity and a five per cent per ton reduction in operating cost.

In addition, information quality and, ultimately, decision-making, in the concentrator arena has been improved with the installation of world-class sampling systems and concentrate batch mass measuring systems.

## Smelter

Impala's smelting operations continued to run well this year, successfully absorbing the increased tonnage inputs from IRS, in particular Kroondal and Western Platinum concentrates.

The expansion project is on schedule with commissioning of the two new converters and the enhanced acid plant expected in October this year. The new 38 MW furnace will be completed in December 2000, ready for start-up in January 2001. Completion of this project will provide capacity for envisaged IRS expansion, as well as increased contingency and flexibility within Impala's own operations. A commercially proven gas scrubbing process has been identified which is capable of treating low concentrations of sulphur dioxide in the furnace off-gas presently released into the atmosphere via the main stack. Commissioning is expected towards the end of 2001.

## Refineries

The year was one of continued success at the Refineries. The final phase of the Enhanced Precious Metals Refinery (EPMR) was successfully commissioned during the year, delivering better than expected first pass yields for platinum and a consequent release from the platinum refining pipeline. A modified process for rhodium recovery was also installed, which had a significant impact on the rhodium first pass yields.

These EPMR achievements, coupled with a consistent performance from the Base Metals Refinery, meant that the overall gross refining cost per ounce of platinum was contained to a commendable less than two per cent increase. Implats' EPMR is now arguably the lowest cost precious metals refinery in the world.